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# THE AMERICAN GAS LIGHT JOURNAL

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[OFFICIAL NOTICE.]

### Cost of Proceedings, Western Gas Association, to Non-Members.

WESTERN GAS ASSOCIATION, OFFICE OF THE SECRETARY,
NEW ALBANY, IND., Sept. 29, 1899.

Bound copies containing the Proceedings of the Western Gas Association for the years 1896–97–98 can be obtained for the sum of $2 each. Make your remittances payable to the Secretary.

JAMES W. DUNBAR, Secy.

## TWENTY-SEVENTH ANNUAL MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.

The 27th annual sessions of the American Gas Light Association, so far as the technical side of its assembling was concerned, were finished this afternoon, by which time is meant the afternoon of Thursday, the 19th inst., and at the outset we may truthfully say that the meeting was a remarkable one in many respects. In the first place, the Association was again holding its convention in New York city after a lapse of almost a decade, its last assembling here having been in 1891, when the arena or debating room was in Scottish Rite Hall, and its acting Secretary then (Mr. A. C. Humphreys) this year directed its proceedings from the President's chair. The business sessions of 1891 took up nominally two days' sessions of two sessions each day: the business of this year's meeting was satisfactorily completed in two days with only one session each day. In the second place, the temperature of the atmosphere this year would well have served for August; but despite the heat the business was transacted with a degree of regularity, order and speed that evidenced that those in attendance were there really for the benefit of themselves and for the advancement of their profession. In the third place, the average attendance at the sessions far exceeded that hitherto reported on the occasion of the meeting of any American Gas Association. Remembering the heat and the attractions of New York generally as a distracting place, the "first, second and third places" named seem to show, if no other causes therefor could be quoted, that the meeting just closed was a remarkable one. So much for the introduction; now for the details of the sessions, which are here given in as concise a form as possible. Promptly, at 10 A.M. of Wednesday, the 18th inst, in the handsome reception hall of Sherry's, at 44th street and Fifth avenue, President Alexander C. Humphreys called the Association to order. Prim he looked, as he peered over his fellow members, and one could not help remembering, when interpreting to himself that first glance, there is the son of a scholar. But the glance was short, as glances in fact generally are, and thereafter the trace of the pedagogue was dissipated in the practice of the methodical man. The regular order being called for, the subsequent course of things was about like this. The minutes of the last meeting having been dispensed with, the report of the Council, in respect of applications for membership, was considered. No less than 52 applications on account of active and 16 on account of associate membership were favorably reported, which tremendous accession rather goes to show that the American is still in the ring for favor and growth. The formalities of election and

introduction of the new members having been completed, the regular report of the Council was taken up. Its lines recited that the papers heretofore named in the Secretary's official notices were approved, that President Morton, of the Stevens Institute of Technology, Hoboken, N. J., would lecture as per the programme, and that the membership of the Committee on Research, which it was proposed to make more permanent, was increased by the naming of Messrs. Rollin Norris and A. E. Forstall thereto. The next important item in the report was an invitation from the Societe Technique de l'Industrie du Gaz en France, that the Association should in some way officially take part in an International Congress of gas men, to be held in Paris, France, next year, probably the 3d and 4th of September, in the "Hall of Congresses" on the Exposition grounds. This invitation was couched in the most fraternal way, and its sentiments brought out a ripple of applause. The report as a whole was accepted, with the further direct understanding that the Secretary should assure the French Society that the co-operation of their American brethren would be freely and fully extended. The reports of the Treasurer and Secretary having been disposed of (both the one and the other evidence quite well the healthy state in which the Association is), Mr. Walton Clark, Chairman of the Trustees of the Gas Educational Fund, presented a statement of the affairs under his and their direction. The report was evidently a revelation to a few who have not had a proper conception of the purposes of those in charge of the educational work, and it astonished many who have favored the scheme with financial and mental support. The success of the work has so far simply been beyond the hopes of its most enthusiastic early promoters. May it go on to greater usefulness and scope. The Committee on Research, through its Chairman, Mr. Alten S. Miller, then presented a short report, and the main burden of its lines was a cry for aid. The Committee evidently was willing to "research;" but volunteers were lacking to enable it to put much on record. The Committee on Nominations then handed in its report as to office bearers for the ensuing year. The presentation was this:

*For President*—Mr. George G. Ramsdell, Phila.
*For First Vice-President*—Mr. E. G. Pratt, Des Moines, Ia.
*For Second Vice-President*—Mr. William R. Beal, New York.
*For Third Vice-President*—Mr. Alten S. Miller, New York.
*For Secretary and Treasurer*—Mr. Alfred E. Forstall, Montclair, N. J.
*For Members of Council*—Messrs. E. G. Cowdery, Milwaukee, Wis.; John Young, Allegheny, Pa.; H. H. White, Portsmouth, Va.; Paul Doty, Grand Rapids, Mich.

It is needless to say that the gentlemen named were unanimously elected, although a good natured growl or two was heard that New York was doing pretty well in the matter of vice presidents. President-elect Ramsdell, whose naming for the first office, even though the naming was known to be a mere formality, was received with applause. In response to a suggestion from President Humphreys that the members would like to hear from him, he acknowledged his promotion in words of sense. He asked the members to help him—and our belief is that they will—to make the meeting of next year a success. The Committee to name next place of meeting was then appointed, after which the Secretary read letters from the Presidents of the Consolidated Gas Company, the Standard Gas Light Company, the Brooklyn Union Gas Company and the New Amsterdam Gas Company, inviting the members and guests to visit the various plants named. They were assured that the button of the Association would be the token that opened the gates. Captain W. H. White here formally extended the freedom of the Lotus Club to the members, with a guarantee, as the Club's Vice-President, that anything the Club could do for them would be feelingly done. The Captain followed this by introducing to the Association Mr. G. Nakagawa, Engineer and Manager of the Tokyo (Japan) Gas Company, who is on a visit to America for the purpose of investigating our gas practice with a view to determining whether we do things here in our mutual line better than they do there. The modest little gentleman having smilingly acknowledged his compliments, President-elect Ramsdell assumed the chair while President Humphreys read his annual address. Its full text will be found on page 647. It cannot fail to receive close attention from our readers, for in its lines many remarkable changes are shown in the opinions of the Humphreys that is compared to the Humphreys that was. However much in it there is for criticism, agreement or dissent will not be considered here and now, but none may deny that it is coherent and scholarly. A round of applause followed the reading, and the message was referred to a committee of three. At this point letters of regret from many, over their inability to be present at the meeting, were read. Those which received special attention were respectively, from Mr. Jas. W. Dunbar, Secretary ot the Western Gas Association, and Mr. E. H. Jenkins, of San Antonio, Texas. The paper list was then taken up, the first being that by Mr. Alexander H. Stecker, of Newark, N. J., whose "Notes on Prepayment Meters" aroused a lively discussion. The consensus of the latter was that "prepayments" are here to stay. The second paper was by Mr. George J. Roberts, of Philadelphia, who gave a most interesting series of paragraphs on "The Pumping of Gas." Mr. Roberts may be a newcomer in the paper arena, but he is evidently an old hand in the engineering field. He knew his ground and always kept piling it, as the lively debate on his paper will show, when the "Year Book" comes out. Mr. Roberts' paper brought the first day's proceedings to a close. And it must be said that the adjourned parties all looked a trifle moist and tired, for the heat of the day was excessive. However, there was much of the afternoon and all of the night in which to recover. The session was called at 10 A. M. and adjourned promptly at 2 P.M.

The second day's proceedings were commenced right on time, as may be well understood when it is said that at 10:15 President Morton commenced his lecture on "Recent Developments in Artificial Lighting." Much grayer he is than when, in 1878, he spoke to the Association over the possible growth and development of the electric light, perhaps a trifle slenderer, too, but the fire of the honest genius that is in him never glowed with steadier brightness than it did in the meeting room last Thursday. We will not attempt to sketch what he said here, nor even to outline it; for in time its repetition will be made in *extenso* and in cold print. The one statement we will make about it now, however, is that the calcic carbide promoters will not be thankful over his references to them. The hearty applause which greeted him when he arose and the cheering which rang when he concluded best spoke how he is held in the gas ranks. The Association, forgetful of its agreement of the day before to vote thanks to none, gave him the heartiest vote that it ever awarded to anyone. The mover of the vote (Mr. Paul Doty) moved it in a very honest sentence. The committee to award the Beal Medal (there never was a string to it) was next named, as follows: Eugene Vanderpool, C. H. Nettleton and A. B. Slater. The report of the Committee on President's Address (presented by Mr. C. F. Prichard) having been accepted, the Association next indorsed the report of the Committee on Next Place of Meeting, who named Denver, Colorado, as the gathering place. The vote, however, was not unanimous. The paper list was again in order, and taken as the numbers were read and discussed, the programme was as follows: "Another View of Interior Illumination," by Mr. F. N. Morton, of Hoboken, N. J.—its text will be found on page 650. "Some Experiments with the Edgerton Standard," by Mr. Rollin Norris, of Philadelphia. "The Steam Consumption in a Water Gas Plant," by Mr. Alten S. Miller, of New York. "Carbureted Water Gas as a Coal Gas Auxiliary," by Mr. A. G. Glasgow, of London, England. The papers were of a high order, and the discussions they provoked were useful and applicable, even if a bit of personality sometimes protruded. At the hour of 2:40 an omnibus vote of thanks, which had the saving grace of being especially directed or presented to the "readers of papers," was passed, and the meeting was at an end, which ending marked a record in the annals of quick time for meetings of gas associations. The headquarters were quite up to mine host Wildey's promises, the meeting room would have been beyond reproach, save for the external temperature, the officers were alert, the attendance (something over 200) was phenomenal, and the meeting was a success.

The banquet, on Thursday evening, held in the main ball room of Sherry's, was commenced at 8 P.M. and it was ended at midnight. The dinner was excellent, the service was likewise. The attendance was about 300, and the proceedings were harmonious, even if at times a trifle monotonous. Many of the members had their wives, their sisters or their sweethearts to protect them, and to the credit of the gentler sex be it said the majority of them stayed it out to the bitter end. The master of ceremonies was Mr. W. H. Gartley, of Philadelphia, and he did his work well. Several clever speeches were made, perhaps the most pointed being that by Mr. Walton Clark, of Philadelphia. Another well put together set of sentiments may be charged to Mr. William McDonald, President of the Western Gas Association, who responded to the toast of "Our Sister Associations."

As the yacht race for the international challenge cup was not decided in the trial spin for Thursday, the understanding at the close of the banquet was that the proposed sail around the harbor and bay, planned as part of the entertainment for Friday, would be so amended as to cause the party (the steamboat chartered for the sail was the seaworthy steamer Laura M. Starin) to join the fleet of boats that will act as convoys to the yachts in their next heat for the cup. The Starin left the foot of West 34th street, at 9 A.M. Friday, but as neither printers nor presses will pass the time for the reception of forms, the end of the story must be told in "our next."

## Address of President A. C. Humphreys, on the Occasion of the Twenty-seventh Annual Meeting, American Gas Light Association, New York, October 18, 19 and 20, 1899.

Fellow Members of the American Gas Light Association: In accordance with the requirements of our by-laws, it now becomes my duty to deliver, and your duty to receive, the President's annual address.

I shall endeavor to lighten your share in this task by referring only to such subjects as at this time seem to me of pre eminent importance. What I have to say will be said impersonally, and with a full sense of my responsibility, in view of the fact that for the time I may be considered as your representative and mouthpiece. I appreciate that the custom which has grown up of accepting the President's address without debate increases my responsibility in this connection.

This has been a year of serious happenings for our industry.

Increase in the price of American oil.

Introduction of an almost revolutionary method of gas production at Boston.

Revival, at more than one point, of gas wars.

Frequent reorganizations and recapitalization (sometimes ill advised in character) of established gas companies.

Renewed impetus to electric light competition through increased efficiency of electrical apparatus and methods.

The establishment, upon what promises to be a permanent basis, of this Association's scheme for assisting the more ambitious young workers in our rank to secure a sufficient education. And all this during a year of unusual national activity and prosperity.

The recent increase in the price of oil has justly occasioned anxiety to gas managers throughout the country. When we consider that not less than 75 per cent. of the illuminating gas manufactured in the United States is water gas, the bulk of which gas is distributed unmixed with coal gas, and that the American consumption of gas oil, which is the chief item of cost in this kind of gas, exceeds 220,000,000 gallons annually, the serious nature of this question is apparent.

In seeking relief from the present oil situation, it is desirable that gas companies should realize their present emancipation from conditions that controlled them in the early days of water gas manufacture. In those days the lighter naphthas and distillates were considered essential for satisfactory gas making; and so long as distillates and residual products were the only supplies available, thus long were gas companies dependent upon the oil refiners, and upon the market conditions necessary for the maintenance of an equilibrium between their many products—a matter of great complication.

Fortunately the apparatus now in general use is capable of handling the *crude oil* with maximum economy; and the ability to use crude oil advantageously means that gas companies are no longer tied down to the complex conditions of the oil refining business, but can go direct to the oil fields for their supplies. Crude oil, freed from water and sediment by the ordinary process of settling, is a gas making material now quite as easily manipulated and fully as valuable as any of the so-called "gas oils."

Thus a possible remedy for the present condition is suggested. Let certain gas companies combine to supply themselves with crude oil direct from the oil fields. To do this effectively it may be advisable for them to become oil producers. This plan would present difficulties; but I am satisfied that they could be overcome. Especially could this remedy be applied in the case of those gas companies operating under a more or less complete system of united management, a form of administration which is on the increase.

More immediately, though perhaps less radical, relief will be obtained from a remedy which will be naturally, automatically applied.

The present high oil prices have been largely created by gas companies displacing more coal gas with water gas than the conditions warranted; especially in the case of the many large companies distributing water gas exclusively. The pendulum has swung too far and the present abnormal prices will merely hasten a readjustment in other respects desirable in the percentages of these two gases. The joint production of coal gas and water gas creates many collateral advantages which are not realized when water gas is made exclusively.

This will lead us to promptly endorse the view, already becoming general in Great Britain, that it is unwise to rely solely upon either coal or oil for raw material. The fact that we have been restricted to the American oil fields, whereas Great Britain is supplied from various oil sources, furnishes us with an additional motive for joint production. Nor should we forget that coal gas can be made in many places in this country at costs as low as are usually recorded in Great Britain. With our larger companies thus making a suitable percentage of coal gas, the smaller companies will generally find it more economical and convenient to manufacture only water gas.

Each manager, with the circumstances, local and general, fully in mind, must not only determine for himself the initial proportions of the two gases which will give the best commercial result, but should establish a system of current analysis that will guide him in continually readjusting these percentages in accordance with the varying market conditions.

In analyzing costs per 1,000 cubic feet, the influence of the manufacture of the one gas upon the cost of the other must be correctly determined and apportioned. Some of you may feel that this reminder is unnecessary. From my experience in the critical examination of the accounts of many gas companies, I feel the hint to be well timed. I believe that in but few cases do such accounts present to those interested the true relative costs of the two gases.

The introduction of the coke oven process into Boston is a matter of possible great importance to our business, and the magnitude of the scheme cannot but command our earnest consideration. Everything which money can achieve has been done to ensure success. The local conditions favor a successful outcome. The process is primarily for the manufacture of coke, which can be made of a quality adapted to metallurgical purposes should a local demand exist or develop for such a product; but in any case there must be a market for large quantities of this fuel if the undertaking is to be a success. Boston is favorably situated for the sale of another form of clean fuel than anthracite, which there commands high prices.

I am credibly informed that the market for the coke has been already secured; the railroads being the best consumers, in connection with their efforts to give their patrons the advantages of a practically smokeless fuel for their locomotives. With a clean fuel supplementing oiled roadbeds, there will be a great increase in the comfort of railway passengers. Besides gas there are two other main residuals—ammonia and tar.

Just what will be the effect on the market for these products, if the output is greatly increased, cannot be foretold; but, in the case of ammonia, I should be inclined to believe that, after reaching a certain lower figure, the development of the demand through such reduced price for agricultural and refrigerating purposes will tend to hold the price at a figure which will afford the necessary return.

That the cost of the gas must be small, if the coke, tar and ammonia can be sold at prices to compare favorably with the cost of the coal and its manipulation, goes without saying. The magnitude of a works of this character lends itself to the most economical methods of handling raw material and products.

I am not prepared to believe that this process is capable of showing comparative advantages if worked on anything short of a large scale.

If my brief presentation of the case is correct, as a gas process it is not adopted to general introduction. From one or other exceptional local conditions, there must be a sure sale for the coke at prices sufficiently high when compared with the cost of the coal.

Pittsburg, as its supply of natural gas becomes exhausted, will afford an example of local conditions most favorable to the process.

Judging by the past, we may be prepared to see this process adopted as a weapon by the professional raider; but where such a raid is threatened, it must not be assumed that the process is necessarily adapted to the locality. This question can only be determined by a competent investigation of the local conditions. While thus ready to discriminate, we can well afford to extend a welcome to this robust newcomer.

The past year has seen a revival of gas wars. In some few cases these have been started by the establishment of rival companies. We have not only to deplore this ruinous, inefficient competition, but we have in some cases to deplore the short sighted policy pursued towards its patrons by the established company which gave the opportunity for a competitor to gain a footing.

In the case of the capital of a neighboring State this class of management, which, by its narrowness and lack of appreciation of the spirit of the times, invited competition, was found to a degree which I am glad to believe is now most unusual in the United States.

We should not be slow to appreciate the lesson here found. Let us be united in our opposition to the invasion of territory of established companies, believing that the peculiar conditions of our business make such competition as a rule wasteful both to the companies and to the consumers involved; but let us also see to it individually that all pretext for competition and raids is avoided by giving to our patrons fair prices, efficient service and courteous treatment.

The unfortunate gas war now in progress in this city is regrettable

from every point of view. We cannot help but see that the gas business throughout the country is injured when, within a few short months, the New York City Companies first unite in declaring to the State and City Governments and to the public that they cannot maintain themselves on the price of $1.00 per 1,000, and then disunite to offer their product at one-half this price. While it is not within our province to express opinions as to where the blame lies for this condition, we must deeply regret the fact and hope that the result will make it abundantly evident to legislators and to the public that the gas business *cannot* be profitably pursued in New York City on the basis of 50 cents for a 1,000 feet of gas, and that this temporary reduction in price was not dictated by legitimate business methods.

About 15 years ago the practice of reorganizing established gas companies began to develop in this country. At first the feeble and badly equipped companies were taken over, and the purchasers made their profit by operating the properties more efficiently and taking to themselves a portion of the increased earnings. This resulted in benefit both to the purchaser and to the gas consumer. But more recently there have been not a few causes where the movement has been purely speculative on the part of the purchaser, and over-capitalization has then been the natural result.

With the demand for cheap gas, warranted within reason by what has been accomplished by some gas companies, and with the more and more serious competition we are called upon to meet from electric light, this evil of over capitalization is to be especially feared. We can so far point with pride to the record made by gas securities, a default on interest being almost unknown; but if this evil develops, we may find our securities sharing in the unsavory reputation made in the financial world by those of many of our railroads.

This brings me naturally to another subject which is one of great importance to us all—our methods of accounting.

*The* object we have in view in keeping general books of account is to determine accurately our profits and so to provide against the impairment of capital by over-estimation of profits.

This means that in the miltifarious transactions of the year, running from thousands of dollars down to cents, we must carefully distinguish between capital and income, and between investment and operating expense.

Every dollar which through error or design is credited to income when it should be credited to capital, and every dollar which is charged to investment when it should be charged to operating, simply impairs our capital to that extent. Stated in this plain way, the proposition is self-evident; but, apparently, it is not so self-evident when overlaid by the intricacies of the daily routine.

I am sorry to say that too often in my professional capacity I have discovered a startling condition in regard to gas companies' accounts; and so much has this matter been driven home upon my mind in the last five years, that I feel that I should be distinctly at fault if I did not avail myself of this extraordinary occasion to give expression to a definite word of warning.

In the early days of our business, the well-established companies made their money with demoralizing ease. The healthy competition of electric light was wanting, the only competitor being kerosene oil, and that by no means so cheap nor so efficient as now.

Gas prices were high and the apparatus and methods employed in works and office were comparatively inefficient. The demand for extension of plant was constant. The profits were such that these extentensions could, generally, be paid for out of profits and still leave enough to satisfy the reasonable demands of the stockholders.

Under such conditions it was natural that faulty and inefficient methods of accounting should develop. I have more than once been able to trace the present evident fault to the lax methods developed through the easy circumstances of the past.

In distinguishing between capital and income, we especially have to bear in mind that the portion of our capital invested in perishable plant must be maintained at par by some method which will compensate for depreciation.

While this again is self-evident as thus stated, I should be sorry to think it self-evident as ordinarily presented; for I should be then forced to believe that the methods of accounting sometimes pursued are the result of dishonest design instead of natural obtuseness developed by the conditions of the business in the past.

In the old days this matter of depreciation was naturally covered by the process I have referred to. The profits invested in extensions and improvements more than covered depreciation. The original plant was finally lost sight of in the improved and extended plant, and it would have been generally regarded as an unnecessary refinement to have closely followed in the accounts the progress of depreciation of original plant. But such a haphazard process was only possible under the enervatingly remunerative conditions of the past.

How is it now, with efficient competition to face from electric light, kerosene oil and perhaps natural gas, and with perhaps a portion or all of the re-invested earnings of the past capitalized under some recent scheme of reorganization.

As compared with the past it may now be necessary to pay interest upon a relatively higher capitalization, while a keener competition necessitates the selling of our product at a lower price. It remains, then, not only to conduct our business with a maxium of efficiency, but furthermore to keep such exact and accurate account of income and expense that we run no risk of paying dividends not earned.

To insure safety we must distinguish at every step between repairs or renewals and improvements or extensions; and, further, we must make systematic provision to cover the depreciation which is daily impairing the capital invested in plant.

Permit me for a moment to come closer to details. So important is this matter to all that I feel warranted in so taking your time; especially as I have found that there is amongst us a great failure to agree on this question of depreciation.

With many companies the question receives no special attention, while others indefinitely depend upon profits re invested in new plant and extensions to provide for depreciation, without stopping to analyze thoroughly to see if, as in the past, there has been a surplus of profits available for the purpose. Others again set aside in one way or another a fixed per cent. of their profits, or of their capital, or of the cost of the plant, assuming that some certain per cent. is capable of uniform application.

It seems to me that the nature of the case should suggest the form of remedy. We have to provide for the final renewal of the present plant; but we know that the plant never will as a whole have to be finally renewed. Parts of the plant will be renewed from time to time; parts will be displaced wholly or in part before the time set for final renewal comes around; and perhaps the manufacturing plant may be entirely rebuilt while yet in good order.

We do not have to give much thought to this last case, although great stress is laid upon it by some. If such a complete change is made in advance of the expiration of life of plant, in all probability it will be because certain extraordinary conditions have arisen which change the original problem and show that on its merits the plant can or must be rebuilt without regard to past capital investment.

For instance, the occupied land becomes so valuable that new land can be purchased where cheaper, and a more efficient plant built with the proceeds of the sale of original real estate. This is an extreme case, but it serves as a fair example of the reasons for rebuilding outside of the established scheme for meeting depreciation. To provide a definite scheme to cover depreciation, we must, as accurately as possible, decide upon the *average* life of the plant in question.

I cannot believe that it serves any useful purpose for engineers and accountants to try to determine with any degree of accuracy a percentage of allowance that can be assumed for *general* application. Each case must be investigated by itself. If we all could first adopt a uniform system of accounting, and then submit to a uniform controling system of auditing, so that as a final result the accounts of all gas companies would be upon a uniform basis, then a uniform percentage allowance could be followed out more fairly. But even under these theoretical and unattainable conditions, such uniformity of allowance would not be admissible, because of primary differences in the character of the plant.

For instance, in some cases the buildings would be of such a flimsy character that it might seem unsafe to assume for them even a life of ten years, and a sinking fund, on a 5 per cent. compound interest basis to pay off the cost of buildings at the end of ten years, would call for the setting aside of 8 per cent. of their cost each year.

Whereas, if the buildings were of such a character, as they might well be, as to promise safely a life of 50 years, then the sinking fund on the same 5 per cent. basis would require only one half of 1 per cent. per annum.

It seems plain to me that proper provision cannot be made to cover renewal of plant unless we analyze each case by itself, first examining the plant and establishing the probable life of each principal portion, and then carefully examining the accounts of the company to determine what provision, if any, is already made, advisedly or otherwise, to meet the renewal of the plant at the end of such life. Such an investigation, in not a few cases, will show that repairs and current renewals are not all charged to operating cost, and that the profits are,

therefore, not as large as claimed. Some striking examples of this unfortunate condition have come under my notice.

To estimate a fair average life it will probably be well to divide the plant under several heads, and these can be again sub divided as indicated by the examination to be desirable.

For instance: Real estate, buildings, holder tanks, holders, retort stacks, retort settings, condensers, scrubbers, purifiers, station meters, main pipes, service pipes, consumers' meters, etc., etc.

Having decided in the case of each division what can be safely assumed as the life of this portion of the plant, we can refer to our annuity tables to determine what per cent. of the original cost of plant annually set aside at compound interest will at the end of the period assumed provide a fund equal to the original cost. Having done this in the case of each item on our list, we can find the total amount to be set aside each year, and then find what per cent. this represents of the total original cost of plant, and this is the amount to be, after some safe manner, re-invested from the annual profits.

An important point is to determine at what rate we can invest the payments to our sinking fund. In those days of low interest bearing securities, 5 per cent. seems hardly attainable with safety. But if our business is a growing one, as it must be if we are to continue in it long enough to make the question of sinking fund important, there will be the opportunity to invest this fund in legitimate extensions of plant required by increased demand for gas.

There should not be the slightest difficulty in thus earning 5 per cent. on this special extension and sinking fund; and, bearing in mind that this new capital has the way prepared for it by the old, the chances are that the new portion of our capital will earn a considerably higher rate. We may then assume 5 per cent. as a safe figure.

It remains then for us to see to it that we pay for extensions each year *out of earnings* an amount equal to the ascertained percentage of cost of original plant and extensions; and that the accounts are kept so as to keep this fund separated from the other accounts involved, that there may be no chance in the future of its being represented, or rather misrepresented, by an additional stock issue.

The figure originally taken as the cost of plant upon which the per cent. for final renewal is taken, will be from year to year increased by the sinking fund amount re-invested in extensions, and so the final renewal of the additional plant built from the sinking fund will be provided for automatically.

The chief difficulty in any such scheme is in arriving at the life of the individual parts of the plant. As a rule, where the accounts are honestly and intelligently kept and repairs and *current renewals* fully charged to operating cost, the per cent. allowance is more apt to be too high than too low. It helps me to a better understanding of this *most* complicated question if there is made a slight change from the usual method of naming the accounts involved.

Instead of "Repairs," I would use the title "Repairs and *Current* Renewals"; or, if considered desirable, divide into two accounts "Repairs" and "Current Renewals," carrying both of them in the final settlement into Profit and Loss.

For "Depreciation" I would prefer the title "Final Renewal."

Thus we have in the title something which has an important bearing upon our analysis of the individual items of plant to determine the average life. The current renewals, if properly made, will result in largely increasing the average life of plant.

Thus some of the items which might be thought to *shorten* the average life of plant, because of their rapid depreciation, would tend to lengthen the average period, since in such items the *current* renewals are wholly or in part eliminating the question of *final* renewals.

"Retort Settings" is a notable case, and "Consumers' Meters" a case less marked.

This point is much more markedly observed in the case of electric light plant, and may well serve as a hint to us that, possibly under present conditions, our electric light competitors have not to provide as much for depreciation as we have sometimes claimed.

Following such a system as I have advised, let us see how we can provide for final renewal of plant on a 5 per cent. sinking fund basis.

Twenty years' average life would require the setting aside out of profits of 3 per cent. of cost of original plant and subsequent extensions: 25 years' average life would require $2\frac{1}{10}$ per cent.; 30 years' $1\frac{1}{2}$ per cent.; 35 years' $1\frac{1}{10}$ per cent.

It will be noted that the method here advocated follows the lines pursued in past years where the profits were abnormal. The difference is that in the past this course was pursued generally without thought of the question of depreciation or renewal, while with us it must be pursued advisedly, for no longer can our consumers be expected to pay for unlimited extensions of plant, *but only so much as will keep our capital unimpaired.* This we have the right to require.

The lack of uniformity in methods of accounting to which I have just referred, and especially as to repairs and renewals of plant, makes it difficult to accurately compare costs per 1,000 of several companies. And still we find questions as to cost of manufacture discussed as if there were some standard system of accounting in operation which permitted such cost figures to be fairly comparable. Much deception, innocent and otherwise, has been possible through this lack of appreciation of the facts.

In opening I especially referred to the subject of electric light competition as being of serious moment. I have incidentally referred to this in connection with other headings. We will probably all be ready to admit, certainly so those who have kept track of elictric light progress, that competition from this source is getting more formidable. The incandescent gas burner helps us to meet this increasing competition. On the other hand, its great comparative efficiency tends to reduce gas sales in the case of the consumers already on our books. We must look to new customers and to the natural inclination of all to use artificial light more liberally as the cost per unit is reduced for the increase of sales from this source.

It can hardly be doubted that this system of gas lighting is destined to be greatly improved and simplified. As sellers of gas we must welcome such progress, even though we may fear the effect upon our gas sales through reduction of individual gas bills. Too long have the best minds in our business devoted themselves unsparingly to reducing the cost of gas at the meter, neglecting the equally important question of how to most efficiently use this gas for the benefit of our customers.

To reduce the cost of our gas by 5 per cent. would be considered by any of us a notable achievement. What should we think of an improvement which enables our customers to get from one foot of gas a lighting effect which by the older method required three feet—an improvement of 200 per cent.? And this does not alone apply to the incandescent burner. Too often the managers who are most conscientious and earnest in looking for improvement in the lines of manufacture and distribution, are careless as to how the gas is applied after it leaves the meter.

The gas manager of the future will, through competition, be forced to see that the gas he has struggled to produce and distribute at lowest possible cost, is consumed through such appliances as will give the customer the highest attainable result in light and heat.

Competition is necessary. Commercial human nature cannot progress without it. Electric light has unquestionably by its competition forced us to pursue better methods to our customers and to ourselves. We could derive more consolation from this consideration if our customers, the public and the local and state governments appreciated the facts; but this is often lost sight of, and a hue and cry is raised for *gas* competition. The general proposition that competition is desirable is quoted against us as if gas and electric light were not for each other completely filling the acknowledged requirements, without bringing competition within our ranks, which, apart from all theorizing, has proved, by most extended and expensive experience, to be wasteful to the gas consumer, the public, the local government and the gas company.

Before closing I wish to say a few words on a subject very close to my heart. Since the last meeting our correspondence scheme of education has been put firmly upon its feet. You will later hear by figures of the actual progress made. These dry figures but imperfectly and coldly set forth the good which is now being done under the direction of the Trustees of the Educational Fund.

It is only about three years since we were assured that it would be impossible to carry through this plan. Even a year ago we were many times met in our requests for subscriptions by the answer that it was foolish to look for sufficient support to even give the plan a trial, and again and again we had to reply that we had already, through three years of individual effort, proved that the plan was practicable and well worthy of support. I hope that before long *every one of the Gas Associations of America will come into line and aid in this work.* They can well afford to co-operate in the plan established, which has purposely been made broad enough and independent enough for all.

I feel sure that the lack of enthusiasm which has been noticeable in certain quarters is really due to lack of information and, therefore, lack of appreciation of the scope and progress of the Trustees' work. I have been often encouraged to find that a more complete understanding of the work led to greater interest, and in some cases even to enthusiasm.

I trust that any of you who have obtained your education by extra-

ordinary personal effort will be led to look into this matter more appreciatively. I have been informed that some of our technically educated men look upon this scheme with suspicion; the idea, as I understand it, being that technical work should be reserved for college men. Remembering how thoroughly this scheme has been supported by the majority of our technically educated members, we can perhaps afford to ignore such opposition from a narrow minority.

When we bear in mind the thousands upon thousands who have received and are now receiving sound general education through the ordinary correspondence schools, we may well ask why should not we succeed in this special case with the requirements of which we are so familiar.

The day will come, if it has not already come, when the American Gas Light Association, with all its splendid record, can afford to point to the establishment of this scheme of education as a sufficient warrant for its existence.

I have not thought it desirable to consume your time while I reminded you of the encouraging developments in our business during the past year. It seems to be more important that we should consider the opportunities for further progress.

Our country has been enjoying a year of extraordinary commercial prosperity, and while our business has not perhaps had its full share in this increase in profits, owing to the fact that our raw materials and supplies have increased in cost, while our product is sold at the old rates, still we may be consoled by the reflection that the stability of our business is thus again demonstrated; for if it is true that in times like the present our profits do not show a proportionate increase, it is likewise true that in times of commercial depression we do not experience a proportionate falling off in profits.

Now, gentlemen, on the eve of our deliberations, let us pause a moment in kindly thought of those co-workers in our ranks who have passed away since we last met.

W. W. Greenough, honorary member, for many years head and front of the Boston gas business, and father of our honored Past-President, was called away June 17th last.

Our old friend, George S. Hookey, died October 18th, of last year.

Jerome Croul of Detroit, who joined our Association in recent years, but who was active in our work and gained our warm esteem, passed away September 26th of this year.

Year by year, as "deceased" is recorded against the names of some upon our roll, we are reminded that our record in this Association, as in every other department of our life's work, must be made while there is yet time!

Your officers in preparing for this meeting have experienced the usual difficulties. Many applications for papers have been met by refusals. I was fortunate in being able to call upon personal friends, my assistants in the past. I wish to gratefully acknowledge their favorable responses, some to applications made at the eleventh hour. But I leave it to you, gentlemen, to say whether it should be necessary for our officers to rely for their papers upon the claims of friendship. Should there not be a surplus of volunteer work?

Let me, at least, urge upon you all the necessity of taking an active part in the discussions. No one should hold back for fear his remarks may seem commonplace, nor hesitate for want of confidence as a speaker. I shall esteem it a privilege if while in this chair I can encourage any one to take part who has been hitherto restrained by diffidence. I can well recommend, in this connection, a careful reading of Mr. Thompson's remarks on this subject in his Presidential address before the last meeting of the Western Gas Association.

## Another View of Interior Illumination.

[A paper read by MR. F. N. MORTON, of Hoboken, N. J., before the Twenty-seventh Annual Meeting of the American Gas Light Association.]

Some time ago my attention was drawn to the question of interior illumination, and particularly as to what really constituted a good light for the eyes. This is a subject which, in spite of its extreme importance, seems to have been greatly neglected by both the medical and technical fraternities, the lack of definite data being most marked.

At first glance it would seem that theory counted for but little in this connection; for while we all know that the dazzling power of any light source is a direct function of its brilliancy and an inverse function of its area, it would seem that this only applied to the light when its direct rays could reach the eye; and that what might be an extremely trying light to look at directly, might be an excellent one for close work, provided it were properly shielded from the eyes.

Among experimenters, the method that seems to be most in favor at present, is that known as indirect lighting. The first trial recorded of this system of lighting was an arrangement devised by Mr. King the elder, at Liverpool, who arranged lines of naked flames above the cornice, the latter concealing the lights. The ceiling, which was curved, then reflected the light to the floor. The same principle, but carried out in a different way, was tried at the Paris Electrical Exposition, in 1881, and in other places in Europe, the method adopted being to place opaque, conical or hemispherical reflectors, large end up, under the lights, thus throwing the light against the ceiling, the only light reaching the occupied part of the room being that reflected and diffused from the ceiling. To prevent unnecessary loss of light by absorption, the ceiling was whitewashed. The light was not altogether satisfactory, and for the opaque reflectors were substituted ground or opal glass of the same shape and similarly disposed, with improved results both as regards quality and quantity of light. Quoting from the abstract of an article which appeared in the Progressive Age of February 1st, 1898: "The comfort of the arrangement is something remarkable; there is no visible source of the light to bother the eye, but there is brightness throughout the room. At first it may seem insufficient, but after a short time it is found extremely pleasant, especially for reading or writing. The cutting off of the direct radiant heat is a very great benefit; and so is the entire absence of shadows, the importance of which has as yet scarcely been sufficiently recognized, and which ought to lead to the general adoption of this method in workshops, the machinery in which ought to be lighted from all sides. It is also a great advantage for scholars to be able to look at the wall maps and diagrams and back at their teacher without their eyes coming across bright sources of light."

This method of indirect lighting was recently tried in this country, the experiment and its results being described by Dr. Myles Standish of Boston, in a paper read before the American Academy of Dental Science. In this paper he says: "One of the great electric light companies in this city got an idea that they would furnish the rooms in which their people were doing fine mechanical work with the best possible light, so they fitted up their draughting and engineer's offices, etc., by painting the ceiling white, and then they put in an arc light; then they put a shade underneath that, the upper side of which was also painted white, and the result of this whole scheme was that the light was thrown up on the ceiling and diffused down, and they had a brilliant white light, but to their utter astonishment everyone complained of the light, and inside of two months two of the four draughtsmen engaged there were patients of mine.

"If you had gone down to see the light they were working in, you would have found yourself in a very brilliantly lighted room. The whole air would have seemed radiant with light, but you would not have found a shadow in that room—you couldn't make a shadow—and the result was that the draughtsmen, who had been accustomed to judging when they had reached a certain point by the angle made between the shadow and the pen or pencil, found themselves obliged to look closely for every point to which they drew a line, and their eyes were kept under a heavy strain all the time, and naturally they soon gave out."

With all deference to Dr. Standish's opinion, I am inclined to question the cause to which he attributes the failure of the eyes of the draughtsmen in the experiment just described. I have myself done a good deal of draughting at one time or another, and was never conscious of working by shadows. Since reading the paper, I did a small amount of draughting, noting that point particularly, and found that, as a rule, I could find no shadow by which to work. My drawing board was placed, by the way, immediately facing a window 3½ feet wide and 6 high. The large size of the window made the diffusion so complete that even under the most favorable circumstances the shadow was so vague that no one could have judged distance by it. I found, however, that I could work with the greatest ease. I believe, therefore, that we must look for the disastrous effect upon the eyes of the draughtsmen in some other direction. This point I have discussed later on in this paper.

A modification of the method of indirect lighting was adopted in the new library of Columbia College. The arrangement is very fully described and illustrated by reproduced photographs in the Progressive Age of March 1st, 1898. In this case a white opaque sphere about 7 feet in diameter was suspended from the central dome of the building, and the rays of 8 arc lamps were concentrated upon this globe by lenses. The description says: "The effect is beautiful in the extreme. The

surface seems translucent and the light seems to come from a certain depth within and to make the whole glow with warm life, and as the ball floats below the ceiling of invisible blue, it is impossible to locate it; whether it is a pearl near us, or a moon in the clear blue sky miles away is left to the imagination.

"It must be remembered that this is not intended as a light by which to read, for the tables all have reading lamps, and indeed the functions of the library might go on without this globe, except that it is needed for architectural effects of light and shade and to dispel the gloomy shadows of the upper dome.

"It may be interesting to state that it is possible to read by the sphere alone on the floor of the reading room, not with comfort, but still with considerable ease. A crude test gives the approximate candle power as about 500, but the light is so white and agreeable that it gives one the impression of greater power."

I have not had an opportunity of seeing this arrangement myself, but those who have tell me that the effect is a general glow throughout the room; but for purposes of illumination the plan is of but little practical value.

An arrangement of the lights in a room was suggested by Dr. Birchmore, in an article which appeared in the American Gas Light Journal of November 29th and December 13th, 1897. The Doctor placed unshaded Welsbach lamps around the room at a height of about 8 feet from the floor, and then reinforced these lights with reflectors placed so as to throw the light outwards and downwards. While I do not deny the artistic effect obtained, the light must have been most trying; as, no matter in what direction the sight was turned, somewhere in the angle of vision would appear a number of naked lights reinforced by reflectors, with correspondingly dazzling effect. A modification of this method may be seen in any number of places, but one that seems very marked is in one of the ferry houses on the west side of New York city. This is lighted by a row of incandescent electric lights placed about 12 feet from the floor and 5 or 6 feet apart, the row being extended all around the room. The diffusion is excellent, but wherever the eyes are turned they encounter a row of dazzling, brilliant points, the effect being extremely trying. Owing to the width of the room and the small distance between the floor and the row of lights, the sight of the lamps cannot be avoided except by keeping the eyes fixed on the floor.

One plan which is frequently adopted is that of having simply a reading light, the rest of the room being in comparative darkness. Here I quote a question put in the discussion that followed the reading of Dr. Standish's paper and the way the Doctor answered. "I would like to ask * * * if an electric light of say 30 or 40-candle power, properly shaded and placed over a roll-top desk, would be injurious?

"You know the way most offices are arranged, the proprietor, who doesn't do anything with his eyes, usually has his desk up near the window; and the bookkeeper, who is constantly using his eyes, is put into the darkest corner of the room. The bookkeeper takes an incandescent electric light and puts it right down in front of him, and when he has a dark shade around it, he thinks he has the very best arrangement he can possibly get; but you can easily picture to yourselves the result of such an arrangement. The whole of that light is thrown down on to a square of reflecting white paper, and there the bookkeeper sits during the whole day, with eyes attuned to darkness by the wall in front of him, looking at a brilliantly illuminated square which is playing havoc with the retinal purple. He works there about six weeks and then he goes and sees the oculist, and the advice that I give—and I think that I give it perhaps fifty times a year to bookkeepers—is to have another light, and preferably a bright gas light, placed just above and behind their heads in such a way as to illuminate the wall in front of them. With that modification they go along very well, and I think I can safely say that I know of one hundred bookkeepers who have taken off their spectacles and have had no further trouble with their eyes, and all they did was to put this extra light behind their heads."

A modification of the method of indirect lighting and a general light with a reading light was suggested by Mr. Beadle at the St. Louis meeting of this Association. He placed opaque shades reflecting upwards under the chandelier lights, and used a well shaded drop light for reading and writing.

Another method of lighting has recently come into prominence, and that is lighting by means of Crooke's tubes. This method is described in detail in the Progressive Age of July 1st, 1898, and a photograph is reproduced of a chapel so lighted and exhibited at the Electrical Exhibition in New York in the Spring of 1898. I went to see the chapel, and found that, as far as color was concerned, the light did very closely resemble daylight, although it had a bluish tinge. There was but little shadow cast, as was claimed by the inventor, Dr. Moore, who first attempted any lighting on a considerable scale by this method. This absence of shadows, however, was due purely and solely to the placing and position of the illuminated tubes in the room so that the shadow cast by one light was illuminated by a number of others, and not at all to the light from this source being able to deviate from a straight line and curl around behind an obstructing medium. As far as the quality of the light is concerned, I have no hesitation in saying that the light was most trying to the eyes. I remained in the room for ten or fifteen minutes, and even for that short time could feel the fatiguing effect; and when I closed my eyes, I could see every one of the tubes almost as distinctly as when looking directly at them, showing complete exhaustion of the retinal purple, and consequent injury to the eyes. An hour after leaving the building, my wife, who was with me, said that her eyes were just recovering from the effects of the light in the chapel, and the next day she complained of discomfort which she attributed to the same cause. There was a slight continual shimmer or vibration in the light, but the same is more or less true of the arc light, and I hardly think it sufficient to account for the distress caused by this method of lighting. What improvements may be made in the future I do not know; but at present the method of lighting by Crooke's tubes cannot be said to be a success as far as being an agreeable or restful light is concerned.

It will be seen from the foregoing that things seem to be in a rather unsettled state. The consensus of opinion is apparently in favor of indirect lighting, but the result in Boston described by Dr. Standish would lead one to doubt this as far as opaque shades are concerned.

In lighting, it would seem that what suited one person did not agree with another, and there seemed to be no good way of determining definitely what really constituted an agreeable and healthy light. In this connection it occurred to me to test the various lights by having some one person read by them, one after another, and then, by counting the number of winks in a given time, determine which light was least fatiguing. This plan was not tried, however, as it was immediately seen that if the reader were unconscious of the test in progress, he would be watching the one operating the stopwatch and would not attend to his book; while if he were aware of the nature of the test, he would wink from sheer nervousness. For a long time, therefore, it seemed as if there were no good way of determining what really constituted a good light except by reading by one or the other until the injury to the eyes was apparent. This plan has obvious drawbacks.

The question had reached this point when a method of testing the lights with a view as to the effect upon the eyes was suggested by an appeal from a member of my family to devise some light by which he could use his eyes for reading and writing at night. For some years his eyes had been giving him much trouble, and for a great part of the time he was unable to use them for reading or writing, either in the day time or at night. At the time he made this request, however, they had so far improved that he was able to read or write to a moderate extent by daylight, but at night he could not use them at all without suffering. It occurred to me that if some light could be devised by which he could read at night, this must necessarily be a healthy light; for what his eyes could stand should prove abundantly satisfactory to almost anyone.

With this end in view, I began a series of experiments concurrently with a mutual friend who was very enthusiastic on the subject of indirect lighting. I will first describe the experiments not made by myself, prefacing by saying that the test applied to each system of lighting was to have the patient read by it until the effect upon his eyes was apparent. It usually took five minutes or less to use up his eyes for the evening.

The first plan tried was that of tinting the Welsbach lamps by which the room was lighted by translucent globes of various colors. Yellow, red, pink, blue and green were tried, but without success. The yellow, instead of tempering the extremely white light of the burners to a pleasant color something like that of an open flame, as was expected, cast an extremely unpleasant yellow glare over the room. The other colors were simply varying in the trying effect on the eyes, the light green, however, being the least unpleasant.

The next plan tried was that of reflecting the light up to the ceiling by means of reflectors, the lamps being arranged around the wall as near the ceiling as it was thought safe to put them. With three Welsbach lamps going, the room was so dark that it was impossible to see to read. It was then seen that to uniformly illuminate the room so many lights would be required that such an arrangement would be out of the question. In continuation of this plan, however, the central chandelier was fitted with opaque conical shades placed apex down, and then various arrangements of reading lights were tried, much in the line

suggested by Mr. Beadle. The drop light was shaded with opal and opaque shades placed in all positions, and also placed under a reflector which would diffuse the light without making it necessary to travel all the way to the ceiling before being reflected back. For the reflector was tried both mirror and white porcelain. None of these experiments seemed to be of any value for the purpose in view, and the idea of indirect lighting had to be abandoned.

Upon considering the reasons for the failure of these experiments, it seemed to me that the trouble was that the light was not uniform throughout the room as long as opaque shades were used. A test of the candle power along any horizontal plane would show a very slight variation in the intensity of the light; but a test in the various vertical planes would show that above the plane of the lights the illumination was intense, as it must necessarily be to obtain sufficient light at the level of the desk or table from a comparatively poor reflecting surface, while in the lower part of the room the illumination was relatively very feeble. In other words, the upper half of the room would be very bright, while the lower half would be comparatively dark. This contrast, together with the intensely brightly lighted ceiling, causing that extremely unpleasant glare always accompanying the reflection of any strong light from a plain white surface, must be more or less trying to the eyes; and in my opinion it was this which injured the eyes of the draughtsmen as described in Dr. Standish's paper, rather than the lack of shadow, as he believed.

In regard to the difference between the opaque and translucent shades, it seems to me that the effect is similar, except that in the latter case part of the light is transmitted, modifying the very great difference between the illumination of the upper and lower part of the room. In other words, an ill effect is introduced by using the opaque shade, and then this difficulty is only modified by making the shade translucent instead of opaque, and thus combining the direct and indirect systems.

In beginning my own experiments, I first tried to analyze the peculiar qualities of daylight which makes it the ideal light, and in so doing started out on the principle that there were four qualities in each light, no matter what its source: steadiness, intensity, color and diffusion. Steadiness is easily obtained by using the Welsbach burner, and intensity by multiplying the number of burners until the required amount of light needed is reached.

The question of diffusion then arose. In investigating this point, I considered as an ideal a room lighted by daylight, but one in which the sun did not shine. This would be the case with an east room in the afternoon, a west room in the morning, and a north room all the time. In analyzing the conditions in such a room, it is evident that the window was the direct source of light, and not the sun. Now as far as diffusion is concerned, we must not lose sight of the fundamental principle that light travels in straight lines; and that if the light from a window is properly diffused, any other light source of the same shape and size will give the same diffusion. Working on this plan, I tried to make an artificial window. This I did by having made a folding screen about 8 feet high and 5 feet wide, hinged in the middle so that it would form two sides, each 2½ feet wide. This screen was set up in a corner of the room and behind it were placed five Welsbach lamps with reflectors to throw all the light towards the screen. The area of the translucent surface was about 10 square feet. The diffusion obtained was good, and, as I had foreseen, just about what would be produced by a window of the same dimensions.

The next question was to determine the shade and color that would nearest approximate daylight. This I tried to determine by testing the various tints that I had at my command by matching delicately tinted fabrics which had previously been matched by daylight. I tried every color available in the shading of the lights, using both reflected and transmitted light, but found that I was entirely unable to get a light that would make the tints match by night as they did by day. I then decided to simply try one shade after another on the screen until one was found that seemed least trying to the eyes. To effect this, tissue paper of various shades and colors were stretched on the screen. All the tints available were tried, the colors being limited, however, to those lighter shades which were not too opaque for the purpose. As in the Welsbach light, the predominating rays seem to be from the green in the spectrum towards the violet end, it was thought that it would be necessary to increase the proportion of red and yellow rays by using a screen of some red or yellow shade, or a mixture of the two colors. It was found upon trial that these two colors were unsuitable, as were screens of plain white, blue, lilac, and violet. After many experiments, it was found that a screen made of a light shade of green was the best; for by this the patient could use his eyes to a considerable extent for both reading and writing.

While this was by far the best form of illumination that had yet been tried, it was not by any means perfect, the screen not being large enough for the distribution desired. It was also thought probable that a light coming more from above would be less trying to the eyes. The mechanical difficulties in making a vertical screen of the desired size caused me to try the effect of a horizontal screen, or sort of canopy, which would also give the desired effect of an overhead source of light. Along the wall was placed a line of five Welsbach burners, six feet from the floor, and immediately under these was stretched a piece of light sea green muslin, 9 feet long and 40 inches wide. This was arranged so that when it was not in use it could be easily rolled up and put away.

The effect of this arrangement was that of a small room lighted entirely through a uniformly illuminated ceiling. The result was very satisfactory, as by this light the patient was able to read in moderation with great comfort and without undue fatigue to his eyes.

It must be remembered that this question is treated purely from a hygienic point of view, and that economy is not considered in the slightest degree. In fact, economy and hygiene are, in the present state of our knowledge, entirely opposed. The most economical light is a naked one reinforced by reflectors, and this is the most trying one to the eyes. Partly for this reason, and partly as this is a question of quantity rather than of intensity of light, and as such is a problem of extreme complexity, I had not the time to make the necessary tests to learn the loss of light through the screen. The effect is the same as that of surrounding any light source with a translucent shade, only carried to an extreme, and shows, I think, the mistake made in using reflected light for illuminating purposes. Reflected light, or indirect illumination, or whatever it may be called, was, in this case at least, an unqualified failure, while simply extending the light giving surface so as to embrace a very large area, so that each unit area would be of comparatively feeble brilliancy, and then tinting to the color least trying to the eyes, was successful.

## The Steam Consumption in a Water Gas Plant.

[A paper read by MR. ALTEN S. MILLER, of New York City, at the Twenty-seventh Annual Meeting of the American Gas Light Association.]

While a great deal has been written and said on the subject of "Purification," the steam used in making water gas has excited little interest, in spite of the fact that it costs from three to five times as much as the purifying labor and material. In this paper, it is intended to show what is actually being done in a gas works, and to see what can be done to cut down the consumption of steam.

Before going further, I wish to give the proper credit for the work done by Messrs. W. C. Morris, M. E., Howard Bruce, C. E., and C. E. Grelle, M. E., who made all the tests, the results of which are given here. Most of the calculations were also made by these gentlemen, so that my work has largely been to assist them and to reduce the results to their present shape.

All of the steam was actually condensed and measured, except that from the blower engines, which was calculated from the indicator cards; the condensation being assumed to be 20 per cent. of the total steam delivered to the engines.

The work given is useful work only. In each case it was calculated from the useful work done in pumping air, gas, oil, etc., in making gas, or in heating oil; except in the case of the shop engine, where it was assumed to be about 65 per cent. of the indicated horse power. The various appliances were tested from time to time and their consumption of steam carefully measured. In most cases, the steam consumption as shown carries with it a certain amount of condensation in the pipes; and in some cases, notably in the case of the drip pump "A," the pipe condensation is excessive.

Some portions of the plant run continually, regardless of the amount of gas made, while other portions consume steam in proportion to the make. In making the tests of the complete plant, care was taken to duplicate as far as possible the conditions of the individual tests; and, when that was not possible, the proper allowance was made.

The table on the following page gives the result of the tests.

In finding the useful work done in heating the oil, the specific heat of the latter was assumed to be .45.

In calculating the useful work done in making water gas, the steam per thousand actually utilized was taken as 15.88 pounds. This figure was taken from the paper presented to this Association by Mr. A. G. Glasgow in 1890. It was checked by actual analysis of the gas.

| Nature of Appliance or use. | Head Pumped Against in lbs. per sq. foot. | Steam Used per 1,000 cu. ft. of Gas Made. Lbs. | Energy of Steam Used in ft. lbs. Above 60° F. | Useful Work Done in ft. lbs. | Per Cent. Efficiency. |
|---|---|---|---|---|---|
| A. Pump | 451 | .6 | 540,060 | 426 | .08 |
| B. Pump | 3,784 | 1.7 | 1,530,170 | 12,548 | .82 |
| C. Pump | 3,784 | 1.7 | 1,530,170 | 25,096 | 1.64 |
| D. Pump | 1,140 | .3 | 270,030 | 1,220 | .45 |
| E. Pump | 3,317 | 1.9 | 1,710,190 | 36,504 | 2.13 |
| F. Pump | 11,520 | .7 | 630,070 | 7,772 | 1.23 |
| G. Pump | 4,464 | .6 | 540,060 | 6,624 | 1.23 |
| H. Pump | 2,150 | .05 | 45,005 | 230 | .51 |
| I. Oil Heater | | 4.0 | 3,600,400 | 2,328,165 | 61.89 |
| J. For making gas | | 29.5 | 26,552,950 | 14,293,588 | 53.83 |
| K. Engine | | 10.9 | 9,811,090 | 264,394 | 2.69 |
| L. Engine | | 5.1 | 4,590,510 | 113,141 | 2.44 |
| M. Engine | | 1.0 | 900,100 | 18,000 | 2 00 |
| N. Engine | | .4 | 360,040 | 2,142 | .59 |
| O. Pump | 118,000 | 1.7 | 1,530,170 | 13,074 | .85 |
| P. Bump | 14,400 | 1.2 | 1,080,120 | 18,640 | 1.73 |
| Q. Condensation | | 1.5 | 1,350,150 | | |
| R. Unac't'd for | | 4.49 | 4,041,449 | | |
| Total water fed to boilers per 1,000 cu. ft. of gas made | | 67.34 | 60,612,734 | 17,141,564 | 28.3 |

A. 6 x 3 x 7 simplex pump. Drip pump.
B. 10 x 7 x 10 duplex pump, run one-third of time. } Used for pumping water from tar separator.
C. 6 x 8½ x 6 duplex pump, run two-thirds of time. }
D. 6 x 4 x 7 duplex condenser pump.
E. 7 x 12 x 12 x 16 compound simplex condenser pump.
F. 6 x 4 x 7 duplex pump for sending oil to apparatus.
G. 6 x 4 x 7 duplex pump to condensers.
H. 7 x 3½ x 12 simplex pump for taking tar from separator.
I. Oil heaters.
J. Used in generators only.
K. 10½x10½ automatic engine for blowers.
L. 12x12 slide valve engine for exhauster, run by throttling.
M. 7½x7½ shop engine automatic cut off.
N. 10x12 hoisting engine on coal tower.
O. 10x3x10 duplex hydraulic pump for operating elevators, etc.
P. 7x13x6x16 simplex compound boiler feed pump.
Q. Condensation actually measured.
R. By difference.

The useful work in raising coal was figured only on the net weight of the coal. The bucket and chain weigh more than the coal lifted each trip, but no allowance was made for these.

On the final tests, the water fed into the boilers was metered and the total water accounted for in the plant checked against this amount. After making all allowances, 67.34 pounds of water were fed into the boilers, of which 62 85 pounds were accounted for, this being 93.3 per cent. of the total. The difference was lost in leaks, emptying pipes before starting pumps and engines, and in various other ways.

The total useful work done represented 28.3 per cent of the heat in the steam above 60° F., the latter being at 100 pounds gauge pressure. If the steam used in the generators and oil heaters, which amounts to almost half the total steam used, is deducted the efficiency is only 1.79 per cent.; one-fourth the condensation and unaccounted for being also deducted. Not more than one fourth the total condensation is chargeable to this apparatus on account of the proximity of the generators and oil heaters to the boilers.

Of the energy represented in the steam exhausted from the blower engines, boiler feed pumps and the oil pumps, 7,234,673 foot pounds is utilized in heating 67.34 pounds of water fed into the boilers from 70° F. to 210° F. This brings the efficiency of the pumps and engines of the plant from 1.79 to 26.64 per cent. This looks very much better, but does not help the case of the outlying machinery, the exhaust of which cannot be utilized for heating the feed water. It is also a fact that the feed water may be put through the gas condenser and heated to 160° F. or over, so that but little steam would be required to bring it to 210°.

In fitting up our plant, a number of pumps were on hand, and these were used in more or less disregard of the work for which they were designed. The result of this is well shown in the case of the pumps "B" and "C," which pump the water from the tar separator to the relief holder. "B" is a 10x7x10 duplex and "C" a 6x8½x6 duplex. The pressure pumped against is only 26 pounds per square inch, so the latter pump is much better suited to the work than the former. This is shown in a marked degree by the fact that the efficiency of "C" is twice as great as that of "B." The drip pump in the tar pit (A) is a simplex, 6x3x7. The head pumped against it but a fraction over 3 pounds, so it is very badly suited for the work. Between the design and the fact that it is on the end of a long pipe which condenses a large part of the steam sent to the pump, the efficiency is almost nothing. Pumps "D" and "F" are the same make and size (6x4x7 duplex.) "D" pumps against a head of 10 pounds to the square inch and "F" against 80 pounds. The efficiency of the former is .45 per cent. against 1.23 per cent. for the latter. A part of this difference may be accounted for by the fact that the speed of "D" is but 60 per cent. of that of "F," but the principal part is due to the fact that the former is not designed for the work it is doing.

Pump "P" is a 7x13x6x16 simplex compound pump, and uses less than half the steam necessary to run a 10x6x12 duplex pump that is arranged to do the same work.

An examination of the foregoing figures shows that economies could be made by properly designing the pumps for the work they are doing; but at most not over 2½ pounds of steam could be saved. The engines are doing about as well as could be expected, and there seems little chance of any considerable saving in the operation of the plant as designed. Small steam pumps are very wasteful, and small engines are far from economical. The only chance to make any considerable saving would seem to be to re design the power plant along the lines of modern practice.

Without attempting to use any of the exhaust steam, it is interesting to see what could be done by re-designing the plant, the problem being to do work equivalent to 519,811 foot pounds for every 1,000 feet of gas made. No attempt would be made to change the steam in the generators or oil heaters, as these are governed by considerations of economy beside which the cost of steam used is a very small figure.

A fairly well designed plant running condensing should generate an electrical horse power with 22 pounds of steam, including condensation and all losses. As modern shop practice is tending toward electricity for small units, we will figure out a plant on this basis.

The average line loss would not be over 5 per cent., as the runs would be short and the wires large.

The average efficiency of the motors would be easily 85 per cent. if kept in good order and run approximately to their capacity.

Thirty-five per cent. at most should represent the friction and losses in an electrically driven pump.

Twenty-five per cent. is a fair allowance for the friction, etc., in a blower driven by a motor on the same shaft.

Allow 30 per cent. for the friction in the exhausters, and 35 per cent. for the friction in the shop engine.

From the design of the coal hoist, probably not over 25 per cent. of the indicated horse power is utilized.

From the foregoing, we can calculate the amount of power that it will be necessary to supply to the various pumps and engines, and the saving over the present method of working.

The useful work done by all the pumps is 122,134 foot pounds, hence 187,898 foot pounds must be furnished.

| | Useful Work. | Necessary Power. |
|---|---|---|
| Pumps | 122,134 | 187,898 |
| K. (Blower engine) | 264,394 | 352,525 |
| L. (Exhauster engine) | 113,141 | 161,630 |
| M. (Shop engine) | 18,000 | 27,692 |
| N. (Hoisting engine) | 2,142 | 8,568 |
| Total | 519,811 | 738,313 |
| Motor losses | | 130,291 |
| | | 868,604 |
| Line losses | | 45,716 |
| | | 914,320 |

This is equivalent to .4618-horse power hour per 1,000 cubic feet of gas made. The steam used to generate this would be 10.16 pounds against 32.34 now used. The efficiency would be 5.7 per cent., or more than three times as great as at present.

In winter a considerable portion of the exhaust steam may be used for heating. The additional cost of piping exhaust steam from the engines driving the electric generators over the cost of the numerous steam connections to the pumps, etc., would not be great, and the plant could be heated by exhaust steam from these engines. Further economies are of course possible in the present plant, but when everything possible has been done, a central source of power will show a saving out of proportion to the cost.

The maintenance of the wires and motors would hardly be greater

than that of the steam piping, engines and steam ends of pumps. The convenience would be very much in favor of such a system. In laying out such a plant it would be necessary to consider the danger from sparks, but this is not a serious matter.

It would be possible to use compressed air instead of steam, and thus prevent the condensation, but the efficiency is low and much trouble is caused by water freezing in the motors.

In conclusion it is hardly necessary to call your attention to the fact that the gas works in question, as well as most others, are laid out with little consideration for the economy of steam. There seems to be no good reason why a gas works of a capacity of 500,000 cubic feet or more a day, should not follow modern shop practice and use all steam, except that used for heating, within 50 or 75 feet of the boilers.

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[From *Engineering*.—Continued from page 613.]

## American Competition.—No. III.

[By Mr. William Kent, Assoc. Ed., *Engineering News*, New York.]

The history of races of living organisms is controlled, according to modern ideas, by two leading conditions: (1) By what is called by evolutionists the "survival of the fittest," the "fittest" here meaning not the most worthy in a moral sense or the most valuable in the market, but simply the one best equipped with weapons, skill, strength, courage, endurance, or other qualities required to enable it to resist attack; (2) by what may be called, for want of a better term, the "amelioration of the environment." For example, in a field sown with delicate plants, and with weeds, the law of the survival of the fittest will dictate that the weeds will ultimately obtain the mastery; in an island peopled with sheep and wolves, the latter will exterminate the former. Such is the operation of natural law of the survival of the fittest; but when man with his reasoning powers steps in and causes an "amelioration of the environment," the weeds and the wolves are destroyed and the more worthy plants and sheep are allowed to thrive.

In like manner, the industrial history of rival nations depends chiefly upon the two conditions, circumstances of the survival of the fittest, and the amelioration of the environment. The first is usually the consequence of the operation unrestricted of natural laws; the second is usually accomplished by the reasoning power of man acting in such a manner as to restrict or modify the operation of such laws.

Sixty years ago the Manchester school of political economists had reached the conclusion that England's industrial welfare would be benefited by withdrawing all obstruction to the operation of the natural law of the survival of the fittest. They repealed the Corn Laws, let the farmer shift for himself, and in so doing ameliorated the environment of the factory workman, enabling him to obtain cheaper food. The theory was that England was the best fitted of all the countries of the earth for manufacturing; that she would supply the markets of the world with manufactured goods; and that foreign countries in turn would compete with each other in supplying her with cheap food and with raw material for manufacture. This theory was a good one from England's standpoint, and the results toward which it tended might have been accomplished had other countries been willing. But they were not. The Americans especially had another theory, to the effect that the law of survival of the fittest would destroy American manufacturing industries, unless the American manufacturer could be enabled to hold his home market by the aid of a protective tariff. This was the "amelioration of the environment" which was suggested by the American theory, and which has been carried out in its protective tariff laws for the greater part of the last half century. The immediate effect of the protective tariff upon American manufacturing industries was to encourage the investment of capital in them, and the employment of vast numbers of laborers. A secondary effect was the increase of wages of the American workmen, to a far higher rate than had ever been paid in Europe. This unfavorable condition the employer met by the substitution of labor-saving machinery for hand labor, wherever practicable. The final result is now seen. The American manufacturer has not only retained his own market, which was all that he originally desired, but he has overcome all the disadvantages of high wages; great distances between the raw material and the market; high rates of interest for money; and foreign prestige. He is competing with England for a share in the trade in manufactures throughout the world, and is even sending many of his manufactured goods into England itself and selling them at prices which the English maker finds it most difficult, if not impossible, to meet.

How great a change has taken place in the relative positions of England and the United States in the iron and steel trade, may be shown in a few words. In 1874 Sir Lowthian Bell made an extensive examination of the iron resources of the United States, the results of which he gave in a paper read before the Iron and Steel Institute the following year. In that paper he said: "The mineral resources of that country are of unquestionable extent, but so are our own, and they will remain so for centuries to come. With labor on anything like equal terms, it is a physical impossibility that iron can be made more cheaply in the United States than it can in England." Sir Lowthian's statement as to the "physical impossibility" was then, and for many years afterwards, accepted as unquestionably true, both in America and in England.

An even stronger statement was made by the present writer eight years later, after a visit to the great steel works of Bolckow, Vaughn & Co. at Middlesbrough, in answer to a question whether the United States were not in a position to compete with England for the iron trade of the work. The reply was to the effect that, in order to equalize the conditions of the two countries, it would be necessary to remove our largest steel works from Pittsburg to a harbor on the Atlantic sea coast; to make the Connellsville (Pennsylvania) coke equal to the Durham; to move the coal mines 300 miles towards the coast; to move the Lake Superior ore mines to tide water on the seaboard; and to cut down by one half both the wages of labor, and the interest on money. No works in the United States had, or could have, the geographical advantages of Middlesbrough, a situation on tide-water with a deep harbor, surrounded by ores for basic steel, and with easy access to the Bessemer ores of Spain; with the best coke in the world within a few miles, and with facilities for obtaining cheap ocean freight rates for its products to all parts of the world.

Since that date the unforseen has happened. All of the "impossibilities" which existed in 1882—the geographical and the physical—have been overcome, and Pittsburg, 400 miles inland, receiving her ore from 1,000 miles to the northwest, can ship her steel 3,500 miles and deliver it at Liverpool, as cheaply as Middlesbrough can deliver it.

How has this wonderful thing been accomplished? Part of it has been the gift of Nature, the Mesabi iron ore ranges, west of Lake Superior, which are not only rich in iron, but are mined very cheaply. Another part has been due to the business foresight and enterprise of an American Scotchman, Mr. Andrew Carnegie, and the skill of many American engineers, his partners. Still another part has been due to the intense rivalry of the owners and managers of American works, who are never satisfied with what they have done, but are always striving to do something better, so as to "get ahead of the other fellow."

The disadvantage of high cost of labor was got over by the use of machinery in every branch of the industry. The pick and shovel and wheelbarrow, and the horse and cart, have been abolished; the ore is mined, and loaded on to cars by machinery; the cars carry 50 gross tons of ore each; they are supplied with automatic brakes, and are drawn by the most powerful locomotives, so as to minimize the cost of moving a train load. The ore is transferred from the train to the 6,000-ton Lake vessel, or *vice versa*, by machinery; it is shifted to the ore bins at the blast-furnace, and from them to the charging barrows, and is elevated and dumped into the blast-furnace, by steam-driven machinery, operated simply by pulling a few levers or moving a few electric switches. Throughout the whole blast-furnace, converter furnace, and rolling mill plant, the same economy of hand labor is manifested. The geographical disadvantage, the great distance of the ore from the coal, and of the furnace from the sea coast, have been overcome by the handling of the ore at the terminals by machinery, and by its transportation in heavy train, or vessel, loads. The high daily wages to each man employed, remain, or have been increased, but the number of men employed per ton of steel made, has been reduced. Another thing that has lessened the cost of production, has been the consolidation of ownership of all branches of the industry, so as to diminish the number of profits. The ore, coal, and limestone lands; the railway cars; and in some cases the railway themselves, and the Lake vessels, are owned by the iron and steel companies.

In other branches of manufacturing industry in which America competes with England for the export trade, the same kind of ideas have been carried out. In locomotives, in stationary engines, in machine tools, in bridges, in electrical machinery, in bicycles, the idea has been to arrive as far as possible at a standard type of construction adapted to the use of a great number of customers; to prepare gauges, templates, patterns, etc.; and wherever possible to employ automatic machinery for the production of the separate parts of each construction, with the utmost economy of time and of hand labor, and with the utmost accuracy, so as to avoid unnecessary hand work in fitting.

There is no tendency to reduce the daily wages of labor in American machine works, but on the contrary, the tendency is to advance them. The piecework system is used to a great extent, and the workman does not object to tending two or four or six machines, if he is able thereby to increase his daily wages. Another cause of the cheap production of American goods is the willingness of the manufacturer to throw into the scrap heap any machine which has become out of date, and to replace it by one capable of turning out work at a less cost, or to tear down a building and erect a new one whenever the new one will cheapen the cost of production.

Perhaps another reason for the recent activity of American workshops in the competition for the world's market, is to be found in the *personnel* of the management, from the general superintendent down to the foremen of departments. The works are managed largely by young men, full of ambition, with no old practices to unlearn, and with no prejudiced conservatism. Many of them are technically educated in the engineering schools, whence they graduate into a couple of years' service at the bench or in the draughting room, where they obtain some knowledge of practice to supplement their theoretical training. Some of these young men develop an ability for salesmanship, and they become excellent students of the needs of customers, and finally superintendents of the selling departments and managing directors.

The American competition in the world's markets for manufactured goods is not a temporary matter. It is bound to increase, and the next time there is a depression in trade in the home market in America, it will attain a magnitude and an intensity which few can imagine.

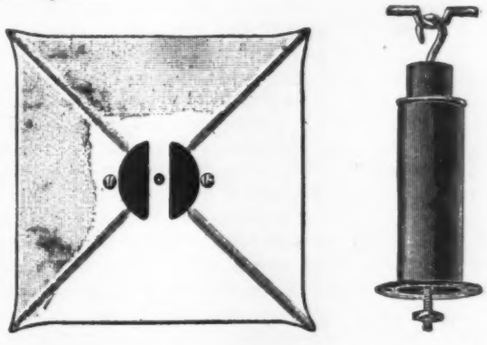
What may England do to meet it? It is easy to say, "Adopt American methods," but it is not so easy to adopt them. Still, it is not impossible. England still has advantages of geographical location for controlling the world's market. In the iron and steel trade she has access to the iron ores of Spain and of Norway, and should be able to put them in her furnaces as cheaply as the ores of Lake Superior can be put into the furnaces of Pittsburg. Her coal may cost more per ton than the coal of Pittsburg, but with modern methods of fuel economy this is not such a great disadvantage. For many years to come she will have lower wages per day to pay to her labor. With the expenditure of a million pounds sterling she might build a locomotive works to turn out locomotives as cheaply as Baldwin; another million or less would provide an American bridge works to build bridges on the American method; for another million the Allis Engine Works of Milwaukee could be duplicated on the English coast, and the Niles Tool Works could be duplicated there, as it is being duplicated near Berlin. The question now is, Will England build these works, or will she wait until American capital and enterprise come over here and builds them, as it did build the Singer sewing machine works near Glasgow? Or will a combination of American enterprise and technical knowledge be made with English capital to build them, such as is being made in the newly projected Westinghouse electric works?

England's trouble with American competition to day is not due to any fault of geographical location nor to any failure of natural resources. It seems rather to be due to the natural peculiarities, or to the prejudices, of her people. Forty years ago the English workshops were the best in the world, her workmen were the best, and so were her products. Every Englishman knew this, as did the rest of the world, and every Englishman was brought up to believe not only that everything English was the best, but that it would always continue to be, and that no improvement was necessary. Meantime, the rest of the world has been advancing, while Englishmen have been content to have things remain as they were. The English owner of workshops has now had his eyes opened, and his mental peculiarity—call it conservatism, or as some do, pigheadedness—will disappear, and he will do his part to retain his fair share of the world's markets; although he must be content to share some of them with America, Germany, Belgium, and perhaps some day, say 20 years hence, with Russia. But what of the English workman? He has a fundamental fallacy implanted in his brain to the effect that the total amount of work to be done is a limited quantity, and if he does too much in a day, or obtains the help of a machine to do more than he has done, there will be less work for him to do to-morrow, or else he will be reducing the amount to be done by his fellow-workman, and "taking the bread out of his mouth." Will he ever get this fallacy dislodged from his brain, and learn that whenever he gets a machine to help him double his day's work, he thereby increases the world's wealth, and makes it possible for him to get a larger share in the division?

The labor question, it seems, therefore, is the greatest factor in the great problem of England's meeting American competition. It cannot be solved by reducing the daily wage of labor. It must be solved by the owner providing the machinery, and by the workman using that machinery to produce double the quantity of work that he has done heretofore. This plan affords the only hope of the workman's having his daily wages increased as they should be, and of England's holding the place her geographical position and natural resources entitle her to in the world's markets.

## The Conversion of Public Lamps for Incandescent Gas Lighting.

The London *Journal* says that to ensure success in incandescent gas lighting in streets and other open spaces, a requirement of the first importance is a suitable lantern. When changing from the old flat flame form of lighting to the incandescent system, if a local authority be wealthy and not parsimonious in expenditure on improving the district, they will in all likelihood go in largely for some of the new lanterns which have been specially designed for the purpose, and which are far removed in appearance and effective performance of their duty from the old-fashioned types of lamps which still disfigure our streets. The box-shaped lantern, with slightly elevated top, surmounted by nothing more ornamental than a plain knob, and set in the hideous shadow-throwing cradle, is certainly an abomination in the sight of all who lay the slightest claim to an artistic taste. But it is not given to all local authorities to rule over a richly populated area, and to have plenty of money at command wherewith to sweep away at will such eyesores; and even in wealthy cities and towns it might not be prudent to altogether discard the old lamps, and incur a heavy expenditure on new ones for narrow and little-used by and back streets. Therefore in and for such places, the best must be made of the lanterns already in existence when it is decided to improve the lighting by adopting the incandescent system.



Numerous have been the devices which we have met with in our travels for bringing old lanterns up to the condition required for protecting incandescent mantles from wind and rain, and for securing the best possible service from them. Some of these expedients have answered fairly well; others have failed to compass the desired end. One of the most effective arrangements to which attention has been called for rendering old lanterns suitable for the reception of incandescent mantles has been brought out by Messrs. H. Greene & Sons, of 19 Farringdon road. It is simple and moderate in cost; its trial during the past twelve months or so has proved its effectiveness; and it admits of the ready conversion of lanterns at home by any gas works hand. The last point is an important one.

The accompanying illustration shows the new parts essential for effecting the conversion. These are made of steel, and the portion shown on the left is enamelled white on its under surface. It is fixed at the top of the body of the lamp, and serves a twofold purpose: It acts as a reflector, and converts the lantern into a double chambered one. It is slightly concave in form, and the corners, as may be observed in the engraving, are tapered, so as to leave a narrow space almost the full length of each side for the passage of the air from the top to feed the burner and support combustion—the manufacturers preferring that the bottom of the lantern should be entirely glazed. In the center of the reflector a circular aperture is provided as shown, and above this is fixed a chimney (the right hand portion of the illustration) for conducting away the products of combustion, and keeping them apart from the incoming air. The whole of the arrangement is kept in position by means of a rod passing through the chimney, and supported on a cross rod fixed in the ventilating holes in the upper part of the top of the lantern. It will thus be seen that the air passing in for the supply of the burner and flame must impinge on the chimney and

upper surface of the reflector, and thereby become heated ; and that, the admission openings being equal on all four sides of the reflector, a uniform distribution of air in the lantern is secured.

By a little further expenditure, additional improvements may be effected. For example, in the roof of the lantern tin blanks may be in serted, with strips of glass along the bottom ; a fine opening being left for the admission of air where the tin overlaps the glass. Then the unsightly cradle may be dispensed with by forging a bolt on to each bottom corner of the frame, to enable it to be fastened by nuts to the frog on the standard. If alterations to this extent are undertaken, clips may also be provided on the inside of the lantern frame for the support of the reflector in place of the hooked rod. The fittings for effecting the conversion of lamps in the manner described are made for 14-inch and other sized lanterns. Where clips are used for support, the reflectors may be made of circular form, and in one piece ; and they can be fitted to either square or circular lanterns. The arrangement, it may be mentioned, has been extensively adopted in South London. We have seen some lanterns which Messrs. Greene & Sons have converted for a Suburban Gas Company, and can testify to their enhanced utility for the purpose for which they are intended, and to their smarter and more modern appearance. The reflector and chimney have also been adapted to some of the new types of lanterns made by the firm.

## Notes from Japan.

Prof. S. Tokano, a noted Japanese engineer, recently furnished to the *Petroleum Gazette* the following details respecting petroleum development in Japan :

A number of discoveries have been made in the new oil fields of Japan during the past six months. The most important is in the territory lying between the Amaze and Miyagowa districts, near the sea coast. The first well was put down by the Japan Oil Company in 1894, but up to the first of this year the annual production was not above 35 barrels per month, though several wells had been drilled. In January, however, a well drilled to a depth of 760 feet, by the Nagaoka Oil Company, started at a rate of 300 barrels, causing a wild excitement and much new drilling, the companies engaged being the Japan Oil Company, Hoden & Company, the Zairo Company, and others. The daily production is now about 800 barrels with new work still going on. The crude is more like that of Niyagowa than Amaze, containing no paraffine and of 33° gravity. Other new fields of less importance are at Taira and Kyu Shyu.

The Niitsu field has furnished many good wells showing a strong pressure everywhere. This field produces a peculiar quality of crude, with odor of camphor, and best suited for the making of 300° headlight oil as well as light lubricator.

As the result of increased production this year several new refining and transporting companies have been established. The Japan Oil Company, with a constantly increasing supply from its own wells, has found it necessary to erect another refinery (No. 2), at Kashiwaki, Echigo province, and the headquarters have been removed to that place. One of the new pipe lines was laid by this Company.

Fifty tank cars have been made by the Ogura Company, of Tokyo, in compliance with one order. They are for use in transporting oil from Echigo to Tokyo. This is the first experience in that line of manufacture in Japan.

The use of tar or heavy residuum, for locomotives, boilers, steamboats and manufacturing plants, is another important departure resulting from the sudden development of the oil industry. Several successful experiments have been made in use as above stated. Its feature of economy, to say nothing of convenience, will be best understood when the cost of coal is considered, being about $20 per ton for the best grades. The supply of fuel oil has also been increased by the importation of Borneo, of Oceanic, crude by the firm of Samuel & Company, representing the Noble Brothers, of Russia. The latter oil is not only going to compete with the domestic production, but will prove a formidable rival for both the American and Russian products in the future.

The Samuel Company is not only engaged in importing, but has also become a producer in the fields of Japan. This is a striking instance of the investment of foreign capital in this country since the open door policy toward foreign investors has been established.

The Japan Oil Company has increased its capital to 600,000 yen, or $300,000. With its semi-annual report for the months from January to June this Company declared a dividend of 40 per cent , including the earnings of the iron works' in connection. Another company in the Nagaoka district paid 35 per cent. earnings, while the lowest dividend, that of the Nagaoka Pipe Line Company, was 20 per cent. Thus it will be seen that the petroleum business of Japan, now in its early infancy, is one of the most profitable in the country, and promises much greater returns when better facilities and larger works have been established. The demand of the present is for simpler drilling methods and refining processes which, owing to the peculiarities of the oil and oil bearing formations, will require a more special application than that of either Russian or American methods.

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE following circular notice, which was issued to those interested, early the second week of this month, explains itself: "You are hereby notified that there will be a meeting of the stockholders of the —— Gas Light Company, at the office of the Company, Grand and Greene streets, in Jersey City, on the 31st day of October, 1899, at 10 o'clock, A.M., to take action upon a joint agreement for merger and consolidation of said Company with the Jersey City Gas Light Company, the Peoples Gas Light Company, of Jersey City, the Consumers Gas Company, of Jersey City, the Hudson County Gas Light Company, and the Bayonne and Greenville Gas Light Company, into a new corporation to be called the Hudson County Gas Company."

WE regret to be called upon to report the death of Mr. Joseph Hendley, who, for two score years, capably served the Beloit (Wis.) Gas Light and Coke Company as Manager. He was its President for about 15 years, succeeding to that position on the death of Mr. Joseph Hackett. Mr. Hendley's death occurred on the morning of the 10th inst. He was in his 84th year, and came to America from England in his early youth.

MR. GEORGE W. GRAVES, of Rochester, N. Y., writing to the JOURNAL under date of the 9th inst., says : "At a recent meeting of a Western State Gas Association the question was asked, 'How can gas companies be induced to buy first class, high grade gas cooking appliances?' This important question was answered by a member of the Association as follows: 'Gas companies can be induced to buy high grade gas cooking appliances by securing them at a low price?' As gas companies could then, and can now, buy high grade gas appliances at a low price, it goes without saying that the gentleman was trying to say that when gas companies could buy a high grade gas range at the same price that they could purchase a low grade one they would buy the former named. And, surprising as it may seem, this frivolous answer was thought so well of that the President of the Association indorsed it in the remark, 'A good answer, and a pointed one.' Taking it for granted that the gentleman who asked the question was desirous of increasing the sale of high grade cooking apparatus, and believing that the permanent use of gas for fuel depends upon the use of high grade articles, I will endeavor to answer the question of how to increase the sale of such goods. First: Persuade the gas companies to handle their appliances on the plan that is known as the 'Rochester, or contract, plan.' So far as my knowledge extends, with one exception, all companies that are pursuing this plan are buying high-grade gas ranges. They give their consumers what the latter should have. Second: Manufacturers of gas appliances should place a retail price on their articles from which there must be no deviation to the consumer, with a discount, say of 30 per cent. to the dealer. This will result in dealers handling the goods, if the gas companies do or do not handle them. I am well aware that this is a radical measure, but it will result in placing the sales of gas ranges on a sound business basis, which is not the case to day. Some gas companies may at first refuse to handle the goods, the same as some of them refused to handle the Welsbach burners, when the latter were originally introduced, but in the end they will come around. While I believe the first plan suggested is the best for gas companies, I also believe the second plan is the best for both the gas companies and the manufacturers of gas appliances, in that it will result in competition with goods sold at a profit. There is no reason why gas appliances should be sold at cost, unless gas is not a desirable article for fuel. In fact, all appliances that are used in connection with other kinds of fuel are sold at a profit of from 30 to 40 per cent. to the retailers. I cannot but think that this is an important question, and that this is the time to discuss it. As the situation now stands, there is no inducement for manufacturers of gas appliances to spend any time or money in making improvements, since their chance of doing business in most cities and towns depends on the manager of the local company, with the main likelihood that he will not approve of the improvements, if such add to the cost of the apparatus or require the giving of extra instructions to the user."

WE understand that the Detroit Gas Company has engaged Messrs. Field & Hinchman to conduct a suit for the purpose of determining whether or not the Citizens Street Railway Company is responsible in a damage sense for the loss occasioned to its pipes by the imperfect construction of defendants' motor system. This means, of course, that the Gas Company believes that defendant is electrolyzing plaintiff's main system through imperfect electric installation.

IT is announced on competent authority that the gas and electric lighting interests of Alliance, O., have been merged. The people in control of the Mutual Light Company (who heretofore were engaged in the supply of gas and electricity in Alliance) have parted with all their holdings to certain capitalists hitherto only concerned in dealing with electric currents in Alliance.

*Engineering News* reports the following interesting decision regarding a case of the firing of a building, in Lexington, S. C., by the electric current: "George W. Miles erected a store building in Lexington, S. C. In front of the structure, and projecting to the street, was a framework to sustain an awning. On the night of June 20, 1897, during a storm, the building caught fire and was burned. Miles claimed that the telegraph company negligently allowed its wire in front of the store to become loosened from one of the insulators attached to the telegraph pole and to sway and fall upon the frame attached to the front of the building, so that the wire, on the night of the storm, conveyed a current or currents of electricity on and into the store building, causing the structure to ignite and burn down. In an action commenced against the telegraph company by Miles the company disputed the facts to the extent of alleging that the building had caught fire first from lightning, and that the heat from the fire caused the defects in the line; further, that if the building did ignite from a current caused by the wire it was an act of God for which it could not be held liable. The company also alleged negligence on the part of Miles in allowing the framework to extend into the street and too near the telegraph line. In Common Pleas Court of Circuit for Lexington county verdict and judgment were given for plaintiff, from which the telegraph company appealed. That judgment has now been affirmed by the South Carolina Supreme Court, the ruling being as follows: A charge that the jury should determine whether the store caused the wire to break by reason of the fact that the store was on fire and heated the wire and caused it to break and become defective, or whether the wire, by reason of the defects complained of, caused the store to ignite, was not a charge on the facts. A charge based on the theory that the company was entitled to a reasonable time, after notice of the falling of the wire, to repair or remove it, was properly refused, as having no application to the case. A land owner cannot be guilty of negligence contributing to an injury caused by telegraph wires in front of his property, because he encroached on the line of poles and wires with his building, so long as the building remained on his own land. In an action against a telegraph company for damages to plaintiff's building caused by a defect in the wires in the street in front of it, the court properly refused to charge that it was incumbent on the plaintiff to exercise the prudence, diligence and care in the erection of his building as was imposed on defendant in the erection of its lines on the street."

THE Berlin Iron Bridge Company, of East Berlin, Conn., has the contract for erecting at Yonkers, N. Y., a grand stand for the racing track of the Empire City Trotting Club. The contract, which includes all the details of the construction, names a structure 100 feet in width and 400 feet in length. Underneath the main seating deck will be located a restaurant, refreshments stands lunch counters and retiring rooms. Located some height above the main seating deck are boxes, suspended from the roof trusses, which arrangement adds very materially to the desirability of the stand and increases the seating capacity to a marked degree. The structure is to be fireproof throughout; in fact, nothing combustible figures in the materials that are to be employed. The framework will be of steel; the floors of brick paving and concrete; the seating deck platform will be of cement and concrete, and the roof covering is to be of corrugated iron. This stand will be one of the largest and best equipped structures of its kind ever built.

THE proposed consolidation at Erie, Pa., of all the local gas and electric lighting interests, has been temporarily thwarted by injunction proceedings by counsel for Mr. D. D. Tracey and other shareholders in the Erie Gas Company. The main contention of the complaining parties is that the Gas Company has not been awarded an equitable share in the recapitalization. The correspondent who forwarded this hint adds: "It looks to me that the complainants have good cause for their appeal to the law, and while I am not a party to the proceedings, I am a holder nevertheless of some stock in the Erie Gas Company, with which I am not disposed to part under the proposed terms of the consolidators."

MR. J. H. BLEDSOE has resigned the position of Manager and Superintendent of the Winnepesaukee Gas and Electric Company, of Franklin, N. H. While not at liberty to state the exact reasons for his resignation, we may without violation of confidence say that he comes to this State to accept a post of far greater responsibility than the one that he relinquished.

MR. THOMAS J. AGNEW, who has been prominent for some time in the management of the Flushing (L. J.) Gas and Electric Light Company, announces that he has at last enlisted the capital necessary to go on with the construction of a gas works in Merida, the capital of Yucatan. The concession for Merida has been owned by Mr. Agnew for some time. He will be General Manager of the Merida Company.

A SURPRISING bit of information is to the effect that Mr. Thomas H. Hintze has resigned the position of Superintendent to the Malden and Melrose (Mass.) Gas Light Company.

MR. F. E. CORBIN has been elected to the vacancy in the Board of Directors of the Southbridge (Mass.) Gas and Electric Company, occasioned by the death of Mr. C. A. Dresser.

A VERY pretty ceremony indeed was that which marked the union in marriage last Tuesday, in Harvard Church, Brookline, Mass., of Elizabeth Sumner Shaw to Mr. Phineas Warren Sprague. If ever a man deserved good fortune it is the groom, and that he is fortunate in this venture all who know the handsome couple heartily agree.

A WELL-KNOWN Superintendent of a good and growing company in the Buckeye State (who prefers, however, that we do not name him), writing to the JOURNAL, under date of the 11th inst., says: Referring to the recent discussion regarding differential rates and the advantages of day consumption, I inclose some statistics that might be interesting. You will notice that the output for December has almost always been beaten by the output for the succeeding July or August, and that the lower set of figures shows that the day output (6 A. M. to 6 P. M.) exceeds that of the night. In October our day and night outputs are about equal. We have repeatedly run day after day, making regular charges, with a variation of "gas on hand" of only 7,000 cubic feet.

THE figures inclosed by our correspondent are appended:

| | 1896. | 1897. | 1898. | 1899. |
|---|---|---|---|---|
| January | 522,990 | 1,015,932 | 1,350,082 | 1,451,023 |
| February | 414,730 | 938,718 | 1,115,913 | 1,360,413 |
| March | 429,340 | 1,004,296 | 1,110,813 | 1,475,640 |
| April | 521,760 | 937,356 | 974,107 | 1,202,706 |
| May | 638,240 | 993,756 | 1,140,431 | 1,321,051 |
| June | 723,500 | 995,078 | 1,239,048 | 1,329,892 |
| July | 845,840 | 1,078,458 | 1,396,608 | 1,493,233 |
| August | 891,750 | 1,163,103 | 1,487,904 | 1,579,619 |
| September | 955,770 | 1,227,538 | 1,523,428 | 1,647,211 |
| October | 1,100,900 | 1,329,142 | 1,557,537 | ..... |
| November | 1,222,752 | 1,308,310 | 1,442,800 | ..... |
| December | 1,242,366 | 1,414,197 | 1,496,397 | ..... |

| | 1899. | |
|---|---|---|
| | Day. | Night. |
| June | 766,558 | 611,334 |
| July | 843,500 | 649,733 |
| August | 918,743 | 660,876 |
| September | 884,041 | 763,170 |

WORK on the construction of the plant for the Nelson (B. C.) Coke and Gas Company has been resumed.

AT the annual meeting of the Geneva (N. Y.) Gas Company the Directors chosen were: A. B. Wright, George F. Duncan, Edward D. Winslow, H. P. Cox, A. Whitney, H. B. Wright and O. H. Wright.

MR. JOHN LAURIS BLAKE, for several years President of the Citizens Gas Light Company, of Newark, N. J. (if we mistake not he was its President at the time of the first merging of its properties with those of the Newark Gas Light Company, died at his residence, Llewellyn Park, N. J., the night of the 10th inst. Deceased, who was born in Boston,

*(Continued on page 658.)*

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

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ELBERT P. CALLENDER,
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*Notification Respecting Advertising.*—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
*Germany*—Lemcke & Buechner, of New York.
*England*—Aug. Siegle, 30 Lime Street, London.

MONDAY, OCT. 23, 1899.

(*Continued from page* 657.)

March 25, 1831, removed with his parents to Orange, N. J., in 1842. He subsequently studied law, in the office of the late Philip Kingsley, of Orange, and was admitted to the bar in 1853. In time he rose to high rank in the councils of the Republican party of New Jersey. In 1880 he was elected to Congress from the 6th New Jersey district. He was a very much esteemed man.

F. R. M. is informed that the last, in fact the current monthly dividend of the San Francisco (Cal.) Gas and Electric Company, was at the rate of 42 cents per share. A gas company for Galena, Mo., is projected.

AT the annual meeting of the shareholders in the Sherbrooke (Quebec) Gas and Water Company, a dividend (semi annual) of 2 per cent. was declared. The Directors elected were Messrs. R. W. Heneker, T. J. Tuck, Walter Blue, A. G. Lomas and F. P. Buck. Special and appropriate reference was made to the retirement from the Company's service of its Secretary and Treasurer, Mr. E. F. Waterhouse, which reference was further accentuated by the presentation to him of a substantial testimonial. Mr. Waterhouse has accepted a responsible place in the main office of the Sun Life Company, Montreal. The Company will make important betterments to its plant next season.

THE Union Light and Power Company, of Salt Lake City, proposes to increase the selling rates for gas to $1.90 and $1.40 per 1,000, respectively on lighting and fuel account, the increase to date from the 1st prox.

## Frequency Meters.

The *Electrical World* says that one of the most vital characteristics of alternating current machinery, viz., the frequency, is never made the subject of indication by means of a meter, as are the voltage and the ampere output. There seems to be in practical work but little demand for anything in the nature of a frequency meter outside of the everyday synchronizing devices, which are differential frequency indicators. The reasons are not difficult to find. The frequency meter is nothing more nor less than a speed indicator of the alternating current generator, or, more properly, a tachometer; and as such indicates only the action of the governor. Since the whole purpose of the governor is to maintain the speed and thereby the voltage constant, any derangement which would seriously interfere with its purpose would be instantly indicated by the voltmeter, rendering a frequency meter or other speed indicating device unnecessary. While tachometers are frequently employed, particularly abroad, their use is more a refinement than a necessity, since governors, as a rule, when they become deranged at all, break down entirely, and their failure becomes instantly apparent in more ways than ours.

If, however, a simple frequency meter with an indicating needle or other device direct reading on a scale of cycles per second could be devised, it would probably be much more popular than is the tachometer, as it would permit the speed to be indicated by an instrument upon the switchboard and directly under the eye of the attendant, instead of located upon the machine and away from other instruments with which it may be desired to compare its indications. The prospects of the appearance of a practicable instrument of this kind would appear to be slight, the various principles upon which such a device could be based being non-applicable to a direct reading instrument.

For example, one of the most successful arrangements for this purpose in laboratory work consists of a wire vibrated by the reaction of the alternating current within it upon the magnetic field around it, the frequency of the vibration being determined either by tuning forks or by calculation from a formula involving the length, tension and weight of the wire. Such an instrument was described in these columns some time since, and there appears on another page of this paper a reprint of a paper read some ten years ago, in which the same instrument was described.

Of course, the adjustment of the length of the wire to give synchronism between the free and forced vibrations, and the reading of the instrument by means of tuning forks, are features that prohibit its adoption for switchboard work. Similar impediments stand in the way of the adaptation of various other combinations employed in scientific work, such as vibrating steel reeds set in motion by alternating current magnets; while the dependence of the indication upon the voltage bars another class of devices, such, for example, as hot-wire indicators, based upon the hysteresis effect. There appears to be no phenomenon of alternating currents on which a meter for this purpose can be based not subject to one or the other of these two objections.

## The Market for Gas Securities.

Dullness and inactivity ruled the city gas share market last week, with little doing in any of the specialties, unless a half-hearted sort of spurt in Amsterdam common may be noted as the exception. Consolidated was weak and strong by turns, selling up to 192 and down to 186. To-day (Friday) the opening was at 188 to 188¼. Conferences of the "magnates" are being held, with the presumable purpose of getting together over gas rates. They should remember, and likely they do, that the sun is going down early these days. Standard common is 111 bid, but more than that will be bid for it soon.

Brooklyn Union is 138 bid. Peoples, of Chicago, shows good strength. The gem of the gas lot, however, "for the rise," was Laclede, which sold above 81. Baltimore Consolidated shows strength. Another stock on the list that will do to put away in the strong box is Western, of Milwaukee. The present state of Bay State leaves much to be desired.

## Gas Stocks.

**Quotations by George W. Close, Broker and Dealer in Gas Stocks.**

16 WALL STREET, NEW YORK CITY.

OCT. 23.

☞ All communications will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

| *N. Y. City Companies.* | *Capital.* | *Par.* | *Bid.* | *Asked.* |
|---|---|---|---|---|
| Consolidated | $39,078,000 | 100 | 188 | 188⅛ |
| Central Union, Bonds, 5's. | 3,000,000 | 1,000 | 107½ | 108½ |
| Equitable Bonds, 6's | 1,000,000 | 1,000 | 105 | . |
| " 1st Con. 5's | 2,300,000 | 1,000 | 115 | 118 |
| Metropolitan Bonds | 658,000 | . | 108 | 112 |
| Mutual | 3,500,000 | 100 | 273 | 300 |
| " Bonds | 1,500,000 | 1,000 | 100 | 102 |
| Municipal Bonds | 750,000 | . | . | . |
| New Amsterdam Gas Co. | 13,000,000 | 100 | 29¾ | 30 |
| Preferred | 10,000,000 | 100 | 56 | 57½ |
| Bonds, 5's | 11,000,000 | 1,000 | 99 | 99½ |
| Northern Union, Bonds, 5's. | 1,250,000 | 1,000 | 95 | 97 |
| New York and East River.. | | | | |
| Bonds 1st 5's | 3,500,000 | 1,000 | 109 | 111 |
| " 1st Con. 5's | 1,500,000 | | 112 | 114 |
| Richmond Co., S. I. | 348,650 | 50 | 70 | .. |
| " Bonds | 100,000 | 1,000 | .. | .. |
| Standard | 5,000,000 | 100 | 111 | 115 |
| Preferred | 5,000,000 | 100 | 130 | 138 |
| Bonds, 1st Mortgage, 5's | 1,500,000 | 1,000 | 112 | 114 |
| Yonkers | 299,65 | 500 | 130 | .. |
| *Out-of-Town Companies.* | | | | |
| Brooklyn Union | 15,000,000 | 100 | 138 | 140 |
| " " Bonds (5's) | 15 000,000 | 1,000 | 118 | 119 |
| Bay State | 50,000,000 | 50 | 1⅝ | 1¾ |
| " Income Bonds | 2,000,000 | 1,000 | .. | 75 |
| Binghamton Gas Works | 450,000 | 100 | 40 | .. |
| " 1st Mtg. 5's | 450,000 | 1,000 | 95 | 98 |
| Boston United Gas Co.— | | | | |
| 1s Series S. F. Trust | 7,000,000 | 1,000 | 92 | .. |
| 2d " " " | 3,000,000 | 1,000 | 68 | 71 |
| Buffalo City Gas Co. | 5,500,000 | 100 | 8 | 9½ |
| " " Bonds, 5's | 5,250,000 | 1,000 | 84 | 85 |
| Central, San Francisco | 2,000,000 | .. | 105 | .. |
| Chicago Gas Co. Guaranteed Gold Bonds | 7,650,000 | 1,000 | 104 | 104¼ |
| Columbus | 1,144,700 | 100 | 70 | 75 |
| 1st Mortgage | 1,207,000 | 1,000 | 106 | 108 |
| Consumers. Jersey City | 2,000,000 | 100 | 100 | .. |
| " Bonds | 600,090 | 1,000 | 107½ | 110 |
| Cincinnati G. & C. Co. | 8,500,000 | 100 | 193¾ | 194 |
| Consumers, Toronto | 1,700,000 | 50 | 230 | 235 |
| Capital, Sacramento | 500,000 | 50 | .. | 35 |
| Bonds (6's) | 150,000 | 1,000 | .. | .. |
| Consolidated, Baltimore | 11,000,000 | 100 | 63 | 63¼ |
| Mortgage, 6's | 3,600,000 | .. | .. | 118 |
| Chesapeake, 1st 6's | 1,000,000 | .. | .. | .. |
| Equitable, 1st 6's | 910,000 | .. | .. | .. |
| Consolidated, 1st 5's | 1,490 000 | .. | .. | 112 |
| Consolidated Gas Co. of N.J. | 1,000,000 | 100 | 21 | 23 |
| " Con. Mtg. 5's | 380,000 | 1,000 | 87 | 90 |
| Consolidated G. & E. Co.'s, Little Falls, N.Y. | 90,000 | 100 | .. | 100 |
| Bonds | 75,000 | .. | .. | 100 |
| Detroit City Gas Co. | 4,560,000 | 50 | 99 | 99½ |
| " Prior Lien 5's | 4,546,000 | 1,000 | 94¼ | 94½ |
| Detroit Gas Co., 5's | 423,000 | 1,000 | 99 | 99½ |
| " Inc. 5's | 31,000 | 100 | .. | .. |
| Equitable Gas & Fuel Co., Chicago, Bonds | 2,000,000 | 1,000 | .. | 101 |
| Fort Wayne | 2,000,000 | .. | 77 | 83 |
| " Bonds | 2,000,000 | .. | 80 | 85 |
| Grand Rapids Gas Lt. Co. | 1,000,000 | 50 | .. | .. |
| " 1st Mtg. 5's | 1,125,000 | 1,000 | .. | .. |
| Hartford | 750,000 | 25 | .. | 220 |
| Indianapolis | 2,000,000 | .. | 122 | 128 |
| " Bonds, 6's | 2 650,000 | .. | 105 | 106 |
| Jackson Gas Co | 250,000 | 50 | 50 | .. |
| " 1st Mtg. 5's | 250,000 | 1,000 | 96 | 100 |
| Jersey City | 750,000 | 20 | 225 | 275 |
| Lafayette Gas Co., Ind. | 1,000,000 | 100 | 68 | 70 |
| Bonds | 1,000,000 | 1,000 | 81 | 86 |
| Louisville | 2,570,000 | 50 | 106 | 108 |
| Laclede, St. Louis | 7,500,000 | 100 | 79½ | 80 |
| Preferred | 2,500,000 | 100 | 101 | 101¼ |
| Bonds | 10,000,000 | 1,000 | 107 | 108 |
| Madison Gas & Elec. Co. | 400,000 | 100 | 82 | 85 |
| " 1st Mtg. 6's | 350,000 | 1,000 | 102 | .. |

| | | | | |
|---|---|---|---|---|
| Montreal, Canada | 2,000,000 | 100 | 200 | .. |
| Newark, N. J., Gas Co | 16,000,000 | .. | 50 | 60 |
| Bonds, 6's | 4,600,000 | .. | 107 | 108 |
| New Haven | 1,000,000 | 25 | 280 | 300 |
| Nashville Gas Lt. Co | 1,000,000 | 50 | 110 | .. |
| Oakland, Cal | 2,000,000 | .. | 53¼ | 55 |
| " Bonds | 750,000 | .. | .. | .. |
| Peoples G. L. & Coke Co., of Chicago | 25,000,000 | 100 | 111⅝ | 111¾ |
| Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage | 20,100,000 | 1,000 | 111½ | 112 |
| 2d " | 2,500,000 | 1,000 | 104 | 105 |
| Peoples, Jersey City | 500,000 | 50 | 215 | .. |
| Rochester Gas & Elec. Co. | 2,150,000 | 50 | 88 | .. |
| Preferred | 2,150,000 | 50 | 118 | .. |
| Consolidated 5's | 2,000,000 | .. | 87½ | 90 |
| San Francisco, Cal. | 10,000,000 | 100 | 70 | 73 |
| St. Paul Gas Light Co | 1,500,000 | 100 | 50 | 52 |
| 1st Mortgage 6's | 650,000 | 1,000 | 82 | 85 |
| Extension, 6's | 600,000 | 1,000 | .. | .. |
| General Mortgage, 5's | 2,428,000 | 1,000 | 80 | 82 |
| St. Joseph Gas Co | 1,000,000 | 100 | 42 | 44 |
| " 1st Mtg. 5's | 750,000 | 1,000 | 96 | 99 |
| Syracuse, N. Y. | 1,750,000 | 100 | 12 | 15 |
| Bonds | 1,612 000 | 1,000 | 81 | 84 |
| Washington, D. C | 2,000,000 | 20 | 280 | .. |
| First mortgage 6's | 600,000 | .. | . | .. |
| Western, Milwaukee | 4,000,000 | 100 | 99 | 100 |
| Bonds, 5's | 3,880,500 | . | 106 | 108 |
| Wilmington, Del | 600,000 | | 220 | 250 |

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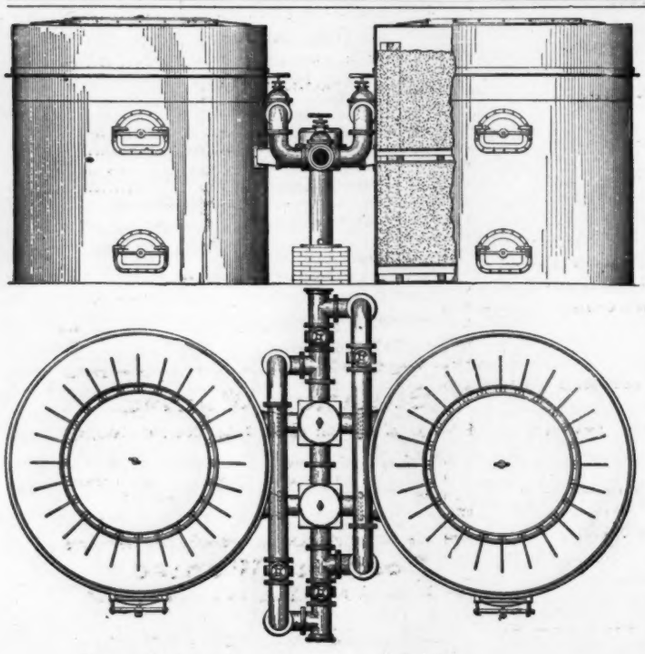

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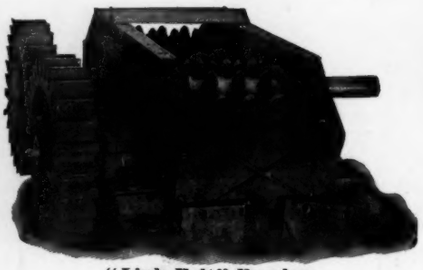

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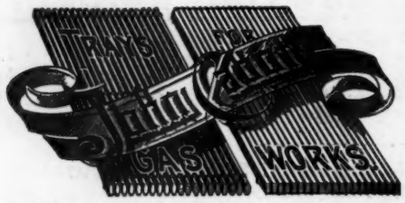


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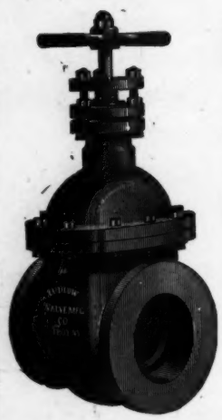

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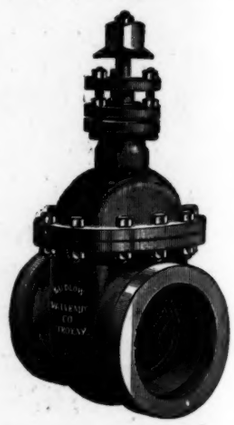

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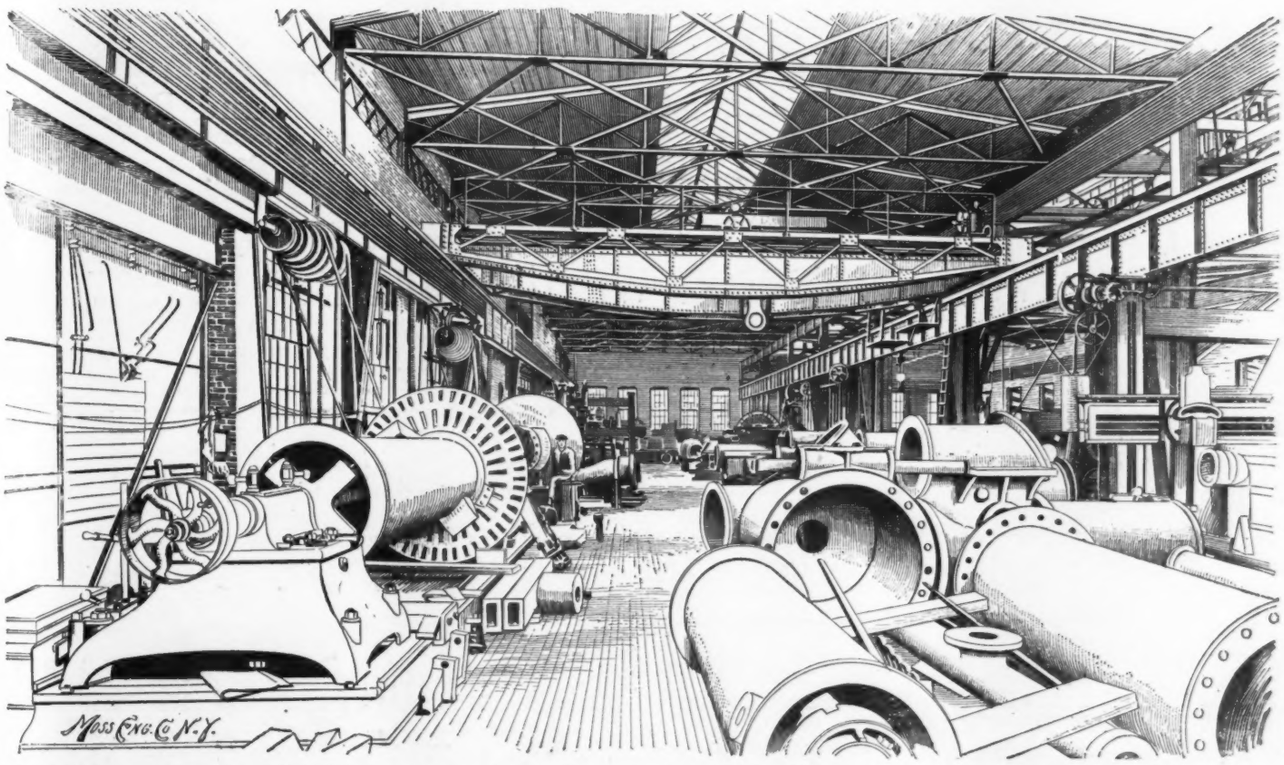


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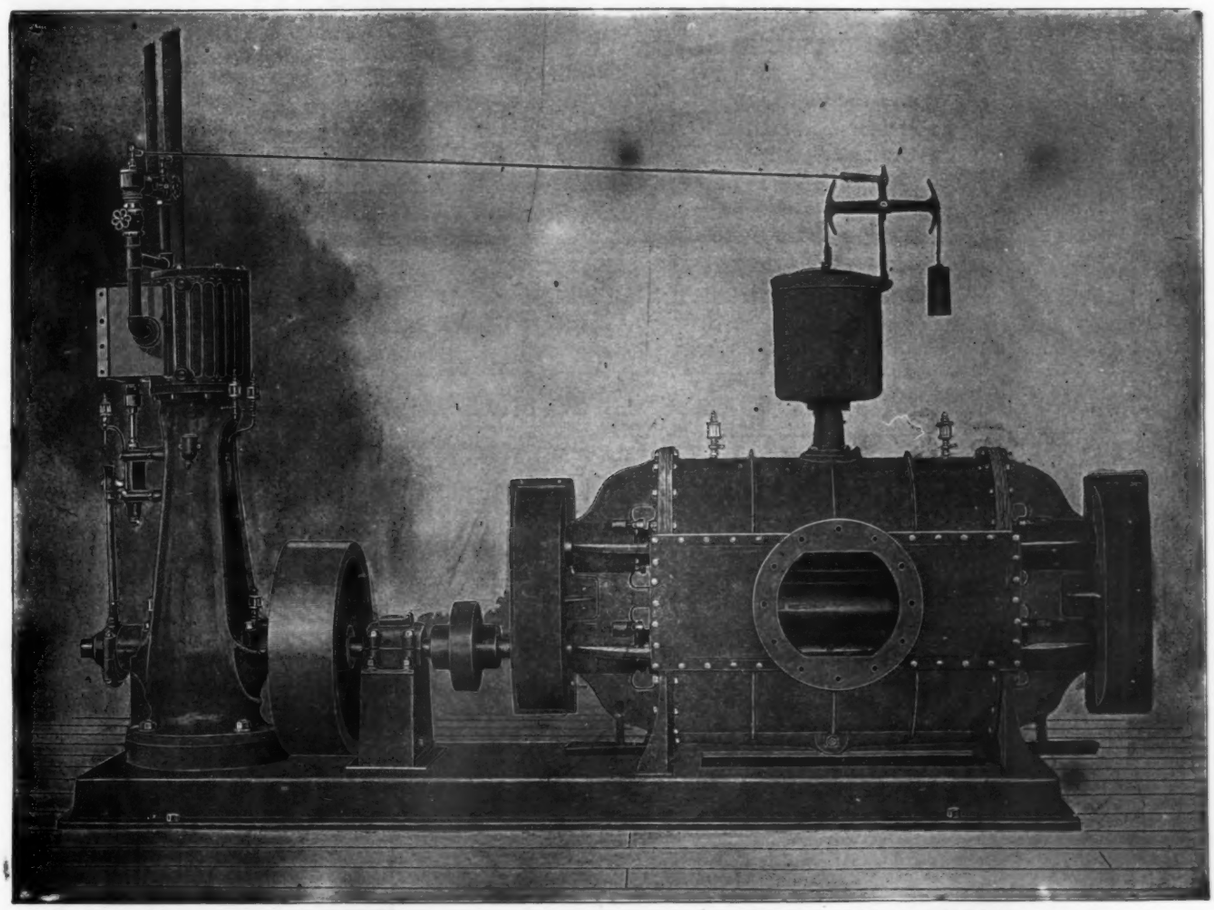

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# Handbook for Gas Engineers and Managers.

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This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

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**Price, $1.00.**

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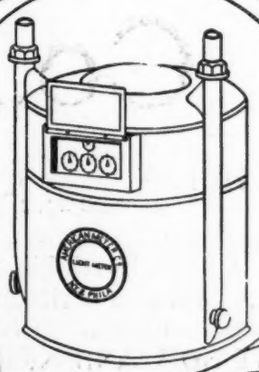
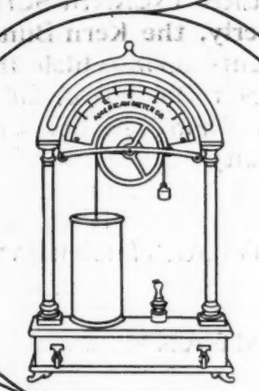
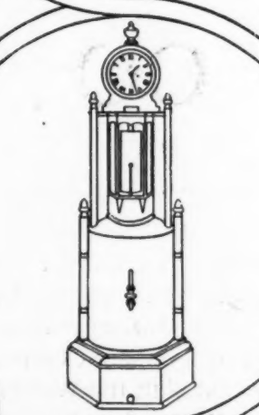
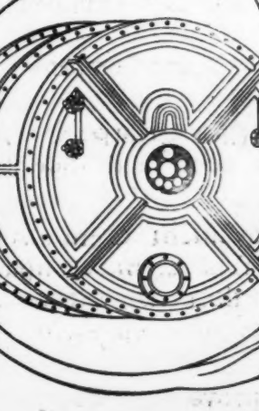








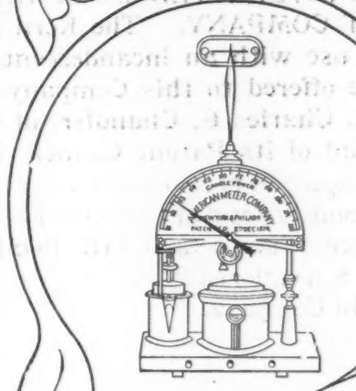
## PUBLIC LIGHTING TABLE.

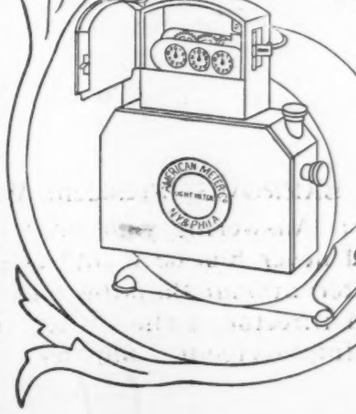
### NOVEMBER, 1899.

| Day of Week. | Table No. 1. Following the Moon. Date. | Light. | Extinguish. | Table No. 2. New York City. All Night Lighting. Light. | Extinguish. |
|---|---|---|---|---|---|
| | | | | P.M. | A.M. |
| Wed. | 1 | 5.30 PM | 5.30 AM | 4.45 | 5.35 |
| Thu. | 2 | 5.30 NM | 5.30 | 4.45 | 5.35 |
| Fri. | 3 | 5.30 | 5.30 | 4.45 | 5.35 |
| Sat. | 4 | 5.30 | 5.30 | 4.45 | 5.35 |
| Sun. | 5 | 5.20 | 5.40 | 4.40 | 5.45 |
| Mon. | 6 | 5.20 | 5.40 | 4.40 | 5.45 |
| Tue. | 7 | 7.30 | 5.40 | 4.40 | 5.45 |
| Wed. | 8 | 8.40 | 5.40 | 4.40 | 5.45 |
| Thu. | 9 | 9.50 | 5.40 | 4.40 | 5 45 |
| Fri. | 10 | 11.00 FQ | 5.40 | 4.40 | 5.45 |
| Sat. | 11 | 12.10 AM | 5.40 | 4.40 | 5.45 |
| Sun. | 12 | 1.20 | 5 40 | 4.30 | 6.00 |
| Mon. | 13 | 2.30 | 5.40 | 4.30 | 6.00 |
| Tue. | 14 | 3.40 | 5.40 | 4 30 | 6.00 |
| Wed. | 15 | No L. | No L. | 4.30 | 6.00 |
| Thu. | 16 | No L. FM | No L. | 4.30 | 6.00 |
| Fri. | 17 | No L | No L. | 4.30 | 6.00 |
| Sat. | 18 | 5.10 PM | 6.40 PM | 4.30 | 6.00 |
| Sun. | 19 | 5.10 | 7.40 | 4.25 | 6.00 |
| Mon. | 20 | 5.10 | 8.30 | 4 25 | 6.00 |
| Tue. | 21 | 5.10 | 9.30 | 4.25 | 6.00 |
| Wed. | 22 | 5.10 | 10.30 | 4.25 | 6.00 |
| Thu. | 23 | 5.10 | 11.30 | 4.25 | 6.00 |
| Fri. | 24 | 5.10 LQ | 12.30 AM | 4.25 | 6.00 |
| Sat. | 25 | 5.10 | 1.30 | 4.25 | 6.00 |
| Sun. | 26 | 5.10 | 2.30 | 4.20 | 6.10 |
| Mon. | 27 | 5.10 | 3.30 | 4.20 | 6.10 |
| Tue. | 28 | 5.10 | 4.30 | 4.20 | 6.10 |
| Wed. | 29 | 5.10 | 6.00 | 4.20 | 6.10 |
| Thu. | 30 | 5.10 | 6.00 | 4.20 | 6.10 |

### TOTAL HOURS LIGHTING DURING 1899.

| By Table No. 1. | Hrs. Min. | By Table No. 2. | Hrs. Min. |
|---|---|---|---|
| January | 215.40 | January | 423.20 |
| February | 184.40 | February | 355.25 |
| March | 187.40 | March | 355.35 |
| April | 166.50 | April | 298.50 |
| May | 158.00 | May | 264.50 |
| June | 140.50 | June | 234.25 |
| July | 150 30 | July | 243.45 |
| August | 168.30 | August | 280.25 |
| September | 179.50 | September | 321.15 |
| October | 213.20 | October | 374.30 |
| November | 217.00 | November | 401.40 |
| December | 238.10 | December | 433.45 |
| Total, yr. | 2221.00 | Total, yr. | 3987.45 |





OFFICE OF THE

# Welsbach Light Co.,

BROAD AND ARCH STREETS,

PHILADELPHIA, PA., June 23, 1899.

*To the Stockholders of the Welsbach Light Company:*

In answer to the many inquiries received from the stockholders as to whether the Welsbach Light Company is interested in the Kern Light or the Kern Incandescent Gas Light Company, I am authorized by the Board of Directors of this Company to advise you that **THIS COMPANY IS NOT NOW AND NEVER HAS BEEN INTERESTED IN EITHER THE KERN LIGHT OR THE KERN INCANDESCENT GAS LIGHT COMPANY. The Kern Light, or, to designate it more properly, the Kern Bunsen Burner for use with an incandescent mantle, and the United States patents upon which it is based, were offered to this Company, which refused to purchase them upon the advice of its experts, Dr. Charles F. Chandler, of Columbia College, and Dr. Waldron Shapleigh, its Chief Chemist, and of its Patent Council, Mr. John R. Bennett, of New York City.**

This Company is not now and never has been interested in the Welsbach Incandescent Gas Light Company of England, nor is that Company interested in this Company. Your attention is called to the following correspondence, which defines **THE POSITION OF THE UNITED GAS IMPROVEMENT COMPANY**, whose name is mentioned in the advertisements which offer for subscription the stock of the Kern Incandescent Gas Light Company.

WELSBACH LIGHT COMPANY,
W. E. BARROWS, President.

---

# WELSBACH LIGHT CO.,

BROAD AND ARCH STREETS,

PHILADELPHIA, PA., June 23d, 1899.

MR. THOMAS DOLAN, President the United Gas Improvement Company:

DEAR SIR: In yesterday's and to-day's New York and Philadelphia papers appear the advertisements of the International Banking and Trust Company soliciting subscriptions to the Capital Stock of the Kern Incandescent Gas Light Company. Among the names of the Directors of the said Trust Company published in the advertisements referred to appears the name of "George W. Elkins, United Gas Improvement Company, Philadelphia." As the United Gas Improvement Company has been prominently identified with the Welsbach Light ever since its introduction into the United States, the publication of its name in these advertisements, which also contain suggestions hostile to this Company, has greatly disquieted many of our shareholders. If you are willing to give me an authoritative statement of the position of the United Gas Improvement Company I shall be greatly obliged. Very truly yours,

W. E. BARROWS, President Welsbach Light Company.

**THE UNITED GAS IMPROVEMENT COMPANY,**
**Broad and Arch Sts., Philadelphia, June 23d, 1899.**

**COL. W. E. BARROWS, President Welsbach Light Company:**

**Dear Sir: Answering your favor of even date, the United Gas Improvement Company is not now and never has been interested either in the Kern Incandescent Gas Light Company or in the International Banking and Trust Company. Mr. George W. Elkins is neither an Officer nor a Director of the United Gas Improvement Company, and does not represent the United Gas Improvement Company. Very truly yours,**

**THOMAS DOLAN, President,**
**United Gas Improvement Company.**

# The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

THE STANDARD JUNIOR,

THE STANDARD DOUBLE SUPERHEATER,

LOWE WATER GAS APPARATUS.

Under Contract, 1899:

| | SETS. | DAILY CAPACITY. |
|---|---|---|
| Fostoria, O. | 1 | 250,000 Cubic Feet. |
| Derby, Conn. | 1 | 750,000 " |
| Lowell, Mass. | 1 | 1,000,000 " |
| Doylestown, Pa. | 1 | 50,000 " |
| Darby, Pa. | 1 | 400,000 " |
| Adrian, Mich. | 1 | 125,000 " |
| Concord, N. H. | 1 | 400,000 " |
| Sioux City, Iowa | 1 | 750,000 " |
| Standard Gas Light Co., New York | 3 | 5,400,000 " |
| Peekskill, N. Y. | 1 | 250,000 " |
| Westchester, N. Y. | 1 | 250,000 " |
| Jersey City, N. J. | 1 | 1,000,000 " |
| Stapleton, N. Y. | 1 | 750,000 " |
| London, O. | 1 | 125,000 " |
| Chicago, Ills. | 2 | 3,600,000 " |
| Putnam, Conn. | 1 | 125,000 " |
| Mansfield, O. | 1 | 250,000 " |
| Plymouth, Pa. | 1 | 125,000 " |
| Athens, Pa. | 1 | 125,000 " |
| Charlotte, N. C. | 1 | 250,000 " |
| Consolidated Gas Co., New York | 2 | 2,000,000 " |
| Quincy, Ills. | 1 | 250,000 " |
| Boone, Ia. | 1 | 125,000 " |
| Webster, Mass. | 1 | 50,000 " |
| Flushing, N. Y. | 1 | 250,000 " |
| Total | 29 | 18,650,000 " |
| Previously built | 294 | 187,100,000 " |
| Grand Total | 323 | 205,750,000 " |

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H. D. ABERNETHY, Sec.

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Water Gas Cupola Linings, Fire Clay, Etc.

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This is the *original* coal-consuming Furnace for Retort Benches. Burns either Coal or Coke. Full and Half-Depth Regenerative Furnaces for Benches of 6's, 7's, 8's or 9's erected complete.

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In Kegs, 100 to 200 " " 6 " "
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AND FIRE CEMENT.

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**Gas Plant Machinery**

SOFT COAL OR COKE
WATER GAS GENERATORS
A SPECIALTY.

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**Gas Engineers**
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PLANS AND ESTIMATES
FOR IMPROVEMENTS OR
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**AUTOMATIC GOVERNOR.**
OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT!
WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION!
REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE!
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**STEAM JET EXHAUSTER.** Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

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FOR CLEANING BOILER TUBES.

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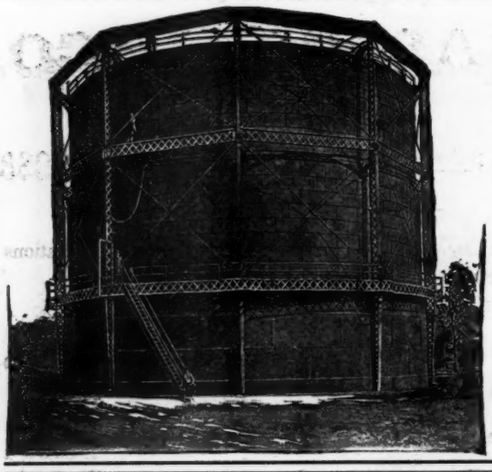

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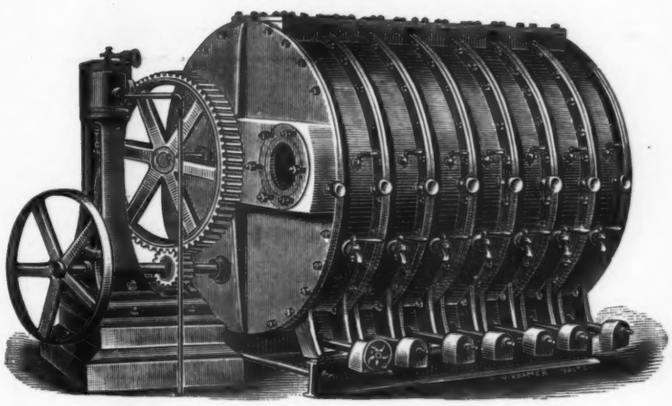

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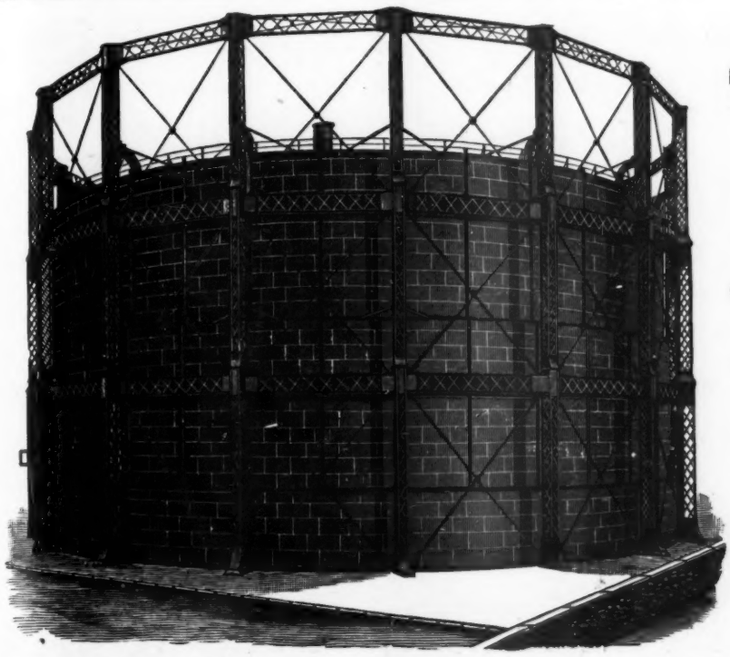

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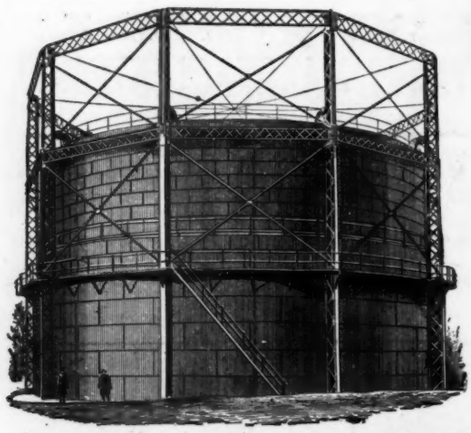

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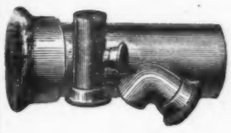

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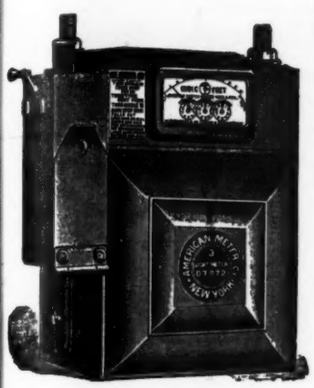

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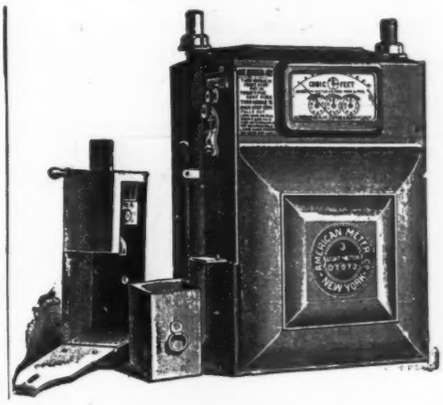

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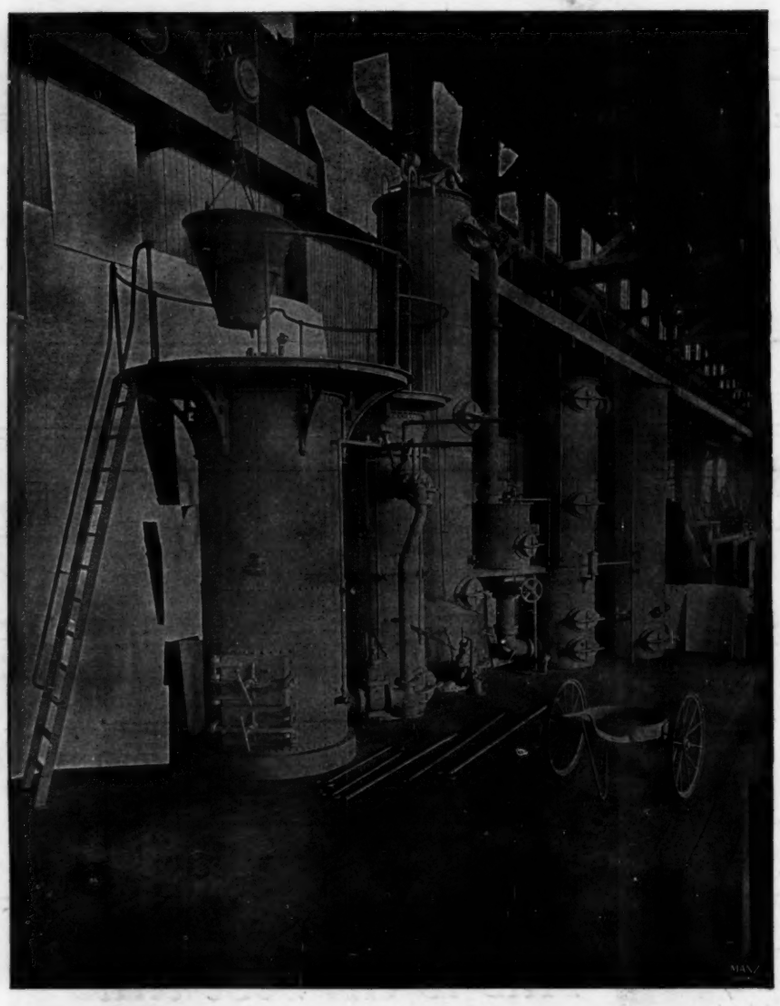

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